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THE DENSITY OF HAIR IN PRIMATES

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INTRODUCTION

There exists a very extensive literature dealing with hair in primates. This has made available a good deal of information in regard to the color, length, thickness, shape, cross-section, implantation, direction, and distribution of hair in man and some of the apes and monkeys. The problem of the density of hair, on the other hand, has curiously enough received almost no attention. The author has been able to find only one paper (Meyer-Lierheim, 1911) which contains data on the density of hair in primates besides man, and these data appertain merely to the fetuses of one monkey and of three apes. Brief references to the density of human hair have been made in very few and scattered publications, which will be mentioned later on.

The present paper records the facts obtained by the first attempt to survey systematically the density of hair in different regions of the body, at different stages of growth, and in different types of primates.

METHODS AND MATERIAL

The density of hair is expressed by the total number of hairs on a given area of skin. The best area to choose for this purpose is one square centimeter. This arbitrary sample area of 1 sq. cm. of skin is selected at a definite location within the bodily region to be studied, and it is assumed that any other nearby sample of equal size contains a closely similar number of hairs. By repeated tests the author has satisfied himself that this assumption is justifiable and that it is not necessary to undertake the laborious task of counting the number of

hairs on an area larger than one square centimeter. For instance, when, in an adult negro, the hairs were counted on four adjoining pieces of skin from the scalp, each measuring 1 sq. cm., the totals obtained were quite similar, *i. e.*, 301, 312, 315, and 320. The degree of accuracy of this method is also indicated by the frequently very close correspondence between the data for different individuals of the same species. For instance, in the two specimens of *Oedipomidas geoffroyi* the following practically identical figures are obtained for the number of hairs per sq. cm. of scalp: 1,228 and 1,214. In two *Alouatta palliata* these numbers are even more closely alike, namely 1,195 and 1,187. It seems reasonable to conclude that whenever very marked individual differences are found they are not due to unreliability of technique but represent individual variations.

The present study deals with three regions; namely, the scalp, the back, and the chest. The skin sample from the scalp was always taken exactly at the vertex, that from the back in the midsagittal plane between the lower angles of the shoulder blades, and that from the chest at a place overlying the lower end of the breast bone.

All the specimens examined had been embalmed so that the skin had become fixed *in situ*. On the particular spot from which a sample is to be taken, a piece of tin was placed containing a hole exactly 1 sq. cm. in size. By means of a small, sharp knife, following the edges of the window in the sheet of tin, a block of skin of the desired size was removed. Before cutting the skin all the hairs belonging to the sample area had been carefully pulled from under the tin and through the window. The hair on this block was then removed by pulling it out or by cutting it off, depending upon the size of the hairs. For the actual counting, these hairs, if dark, were spread on a large sheet of white paper, if light, on a sheet of black paper. Extremely fine hairs, two millimeters and less in length, were disregarded, except in the case of fetuses.

As listed in tables 1 to 4, the material examined consists of 71 primates and, for a preliminary comparison, of one rodent and one carnivore. As mentioned before, all these specimens had been embalmed and most of them had been stored completely submerged in preserving fluid so that the skin had retained its natural size as well as all the implanted hairs, present at death. The great majority of the specimens has been collected by the author and is now in the anatomical collection of the Johns Hopkins University (abbreviated in the tables

as "H"). The adult Hawaiian and Chinese have been catalogued in the Laboratory of Physical Anthropology of the same university ("P. A. L."). The two small orang-utans and the siamang belong to the National Museum in Washington ("N."), one juvenile gorilla to the American Museum of Natural History ("A."), and the two embalmed adult gorillas were secured on the Columbia University—American Museum African Expedition ("C. A."). For their generous permission to examine the latter specimens the author is indebted to Mr. Gerrit S. Miller, Jr., Prof. William K. Gregory, and Dr. Dudley J. Morton.

All the species names of primates, as used in this paper, are according to Elliot (1913). Specimens which never lived in captivity and were shot in their native environment are marked in the tables by an asterisk. It must be mentioned also that for this study no specimen was used in which the coat of hair could be suspected of being in any way abnormal. Several of the author's chimpanzees, *e. g.,* have been excluded on account of the fact that their hair was evidently in a generally poor condition. Likewise, many human bodies have not been considered because they showed signs of beginning baldness.

Besides the sex and age of each specimen the tables contain the height of the trunk (from suprasternal notch to upper edge of pubic symphysis, measured with sliding compass) which serves to show the size of each particular primate. The first three columns of figures give the absolute number of hairs per sq. cm.; in the next two columns these absolute numbers are expressed in percentage of the number for the scalp, thus showing the relative density in the different regions. For instance, the prairie dog has 2,306 hairs per sq. cm. on the scalp but only 978 on the chest; the density of hair, therefore, is less than half (42 per cent) as great on the chest as on the head.

After having found the number of hairs per sq. cm., one is able to calculate in an approximate manner the total number of hairs in a particular region by multiplying the former by the number of square centimeters contained in this entire region. For this purpose the area of the scalp is assumed to represent roughly a hemisphere with a diameter equal to the head length (glabella to most distant point on occiput). The surface area of this hemisphere is obtained according to the formula $1.571 \times D^2$, D representing the diameter, *i. e.,* the head length. In a similar manner, the trunk is simply regarded as a cylinder with a surface area equal to the product of chest circumference and trunk

height. The back and the "chest" (+ abdomen) are each assigned one half of this trunk surface. Naturally these simplified calculations of surface area can represent merely a very generalized approximation of the real and exact skin areas. It must be emphasized, therefore, that the "total number of hairs," given in the last three columns of the tables, cannot claim any great exactitude. The reliability of these figures is limited by the margin of error in the two assumptions: (1) that the density of hair is on an average the same in all the units of surface area of a particular region and (2) that these regions have a simple geometrical form. It is readily admitted that both these schematized claims cannot be absolutely correct and may even deviate considerably from the actual conditions. The present method seems, nevertheless, fully justifiable as producing with a reasonable amount of effort an approximate idea of the total number of hairs in certain bodily regions of different animals. It would never be worth the tremendous effort actually to count all of the hairs on, *e. g.*, the back of a cat, when this number can be approximated as 2,153,000 (see Table 1) by counting only the 3,968 hairs on one sq. cm. and by simply multiplying this figure by the number of sq. cm. (542.5) in the approximate area of the back. Based upon a few tests on small and not very hairy animals the author doubts very much that an actual count would ever change these approximate figures by much beyond 15 per cent of the value of the latter. These calculated total numbers of hairs are chiefly intended to show the degree of hairiness of an animal. This degree is not evident from the density of hair alone. For instance, one *Aotus* has over 4,000 hairs per sq. cm. on the scalp, whereas one *Lagothrix* has only slightly more than 2,500 hairs, yet the total number of head hairs in the former is only 194,400, whereas in the latter it is 346,300. Attention is here called to the fact that for the sake of convenience the total numbers of hairs, as listed in the tables, have been divided by 1,000 to one decimal point, since less than 100 hairs are of no significance in these totals.

INFLUENCE OF CAPTIVITY

Before the data in the tables are discussed in detail it is necessary to comment briefly on the possibility that captivity influences the density of hair. There can be no doubt that in some instances captive animals receive an insufficient diet or are confined in an unsuitable environment, which fails to provide adequate sunlight, fresh air, humidity, etc. Under such conditions primates might rapidly lose some of their hair. It seems

much less likely, though not impossible, that climatic differences between the zoological gardens in temperate zones and the original tropical home of the captive specimens could change the density of hair. In all probability most climatic factors can influence merely the length of hair. That captivity does not necessarily change the density of hair is clearly proved by the example of the five specimens of *Hylobates leuciscus* listed in Table 3. Two of these gibbons were shot in Java and the other three had lived for considerable time in the National Zoological Park in Washington, D. C. None of the figures for the captive specimens differ significantly from those obtained for the wild gibbons. Of the two specimens of *Saimiri* (Table 1) one had lived several years in captivity in a northern climate, the other was shot in Panama. In spite of this environmental difference the density of hair is in both specimens exactly the same on the back, slightly greater on the head in the wild animal, but somewhat greater on the chest in the captive specimen. The latter two almost negligible discrepancies may easily represent nothing but individual or specific differences and can certainly not be used as proof for an influence of captivity upon the density of hair.

DENSITY OF HAIR ON THE SCALP

The number of hairs per sq. cm. on the scalp ranges among primates from 112 in an adult chimpanzee to 4,083 in an adult *Aotus*. The latter figure represents the greatest density found among all the primates in all three bodily regions studied. It is surpassed only by the number of hairs on the vertex of the cat (4,503). A close study of the tables reveals the fact that in general the density of hair on the scalp is very much greater in platyrrhines than in the lower catarrhines; it is very marked in the gibbons, and extremely little pronounced in anthropoid apes and man. This is most clearly shown by the following averages, which do not include the fetuses and the siamang: Hairs per sq. cm. on scalp in 15 platyrrhines = 1,852; in 16 catarrhine monkeys = 910; in 9 gibbons = 2,035; in 13 anthropoid apes = 307; and in 15 individuals of man = 312. Among all primates the densest hair on the scalp is found in the platyrrhine night monkey, *Aotus*. Second in this respect stands another platyrrhine, the woolly monkey, *Lagothrix*. The latter is followed by the gibbons, which show considerable constancy in this feature. All the different gibbon species are characterized by a much greater density of scalp hair than exists in the siamang (*Symphalangus syndactylus*). The particular siamang used for this study is a per-

fectly normal specimen with a fine, even coat of hair, and was very lively and apparently in the best of health shortly before its sudden death. Among the lower catarrhines *Lasiopyga* has the greatest density, possessing on an average 1,882 hairs on a sq. cm. of skin at the vertex. The corresponding average for baboons, on the other hand, amounts to only 543.

It is of great interest to find that the density of scalp hair in man surpasses that of most anthropoid apes. The author's adult orang-utan gives the impression of having an abundant coat of very long hair, yet repeated counts show only 158 scalp hairs per sq. cm. Of the two large chimpanzees, the male has 258 hairs and the female only 112. This female ("Dwina" of the colony of Prof. Robert M. Yerkes) appears to be even unusually well covered with hair and the selected samples of skin were adequately preserved. These figures are far below the maximum found in adult man, *i. e.*, 401. Only in adult gorilla is the density of the scalp hair slightly greater than in man (411 and 469 hairs per sq. cm.).

Within the species *Homo sapiens* there seem to exist some racial differences in regard to the density of hair on the scalp. The six adult negroes have on an average 297 hairs per sq. cm. and the three adult whites 333 hairs. In two adult whites v. Brunn (1897) counted 300 and 320 hairs on a sq. cm. of skin at the vertex. The Hawaiian has only 216 hairs and the adult Chinese as few as 128. Even at birth the Chinese has fewer hairs (224) than the white (458) or the negro (434). Birkner (1906) found on the head of one adult Chinese 202 hairs per sq. cm., and Bushmakin (1928) states that in the Mongolian race of Buriats there are "not more than 110 to 120 hairs on a square centimeter" of the scalp. Japanese seem to have a greater hair density according to Baelz (1883) who obtained the following figures for four adults: 280, 298, 317, and 320. The same author quotes Hilgendorf as having found in two other Japanese 252 and 286 hairs per sq. cm. of scalp surface. By combining the available records on 10 adult Mongolians (2 Chinese, 2 ? Buriats, 6 Japanese) 231 hairs are obtained as a tentative average value for the density of scalp hair in this race. This average lies considerably below that of whites and that of negroes.

DENSITY OF HAIR ON THE BACK

The density of hair on the back resembles in many respects the conditions of the density of hair on the scalp. The maximum density

on the back is again found in the cat with almost 4,000 hairs per sq. cm. The maximum among primates occurs, as in the case of the scalp, in *Aotus* with nearly 3,000 hairs. The minimum is, of course, represented by man with his practically complete hairlessness on the back. The marked general differences in density of hair on the back between the different groups of primates are best shown by the following averages (without the few fetuses): Number of hairs per sq. cm. in 15 platyrrhines = 1,737; in 16 catarrhine monkeys = 866; in 8 gibbons = 1,727; and in 13 anthropoid apes = 276. It is very remarkable that the large apes have so few hairs per sq. cm. on the back in comparison with the lower primates. In one adult chimpanzee there are only 48 hairs and in the two adult gorillas 109 and 145 respectively. In some of the gibbons, on the other hand, this number rises to above 2,000. These new data indicate a general evolutionary trend toward elimination, or at least reduction, of hair per sq. cm. on the backs of all higher primates. The density of hair in this region is on a rough average 870 in the Old World monkeys, 280 in the large apes, and 0 in man. The difference between the former two figures is very much greater than that between the latter two.

It must be pointed out in this connection that marked differences in the density of hair on the back exist within all the major groups of primates. Among the platyrrhines the most highly specialized form, the spider monkey, has by far the smallest number of hairs; namely, on an average only 651. Among the other New World monkeys, this number ranges from 1,047 to 2,985. Among the catarrhine monkeys the Hamadryas baboon with its long mantle on the back has only 177 hairs, whereas one of the Guenons has 2,275 hairs. In the family of *Hylobatidae* the siamang has only 429 hairs; in the true gibbons, on the other hand, there are anywhere from 1,174 to 2,169 hairs.

DENSITY OF HAIR ON THE CHEST

The density of hair on the chest is in general less than on the back or on the scalp. The greatest density among primates is again found in *Aotus* with as many as 1,232 hairs per sq. cm. This maximum in primates is greatly surpassed by the density of chest hair in the cat, which amounts to 2,781 hairs. It can now be stated that no primate has as dense a coat of hair as has at least one carnivore, since the cat has the greatest densities in all of the bodily regions studied.

As on the scalp and on the back, the density of hair on the chest is in general greatest in platyrrhines and in gibbons and least in anthropoid apes and man, with the lower catarrhines occupying a middle position. This is clearly shown by the following averages (disregarding the few fetuses): Number of hairs per sq. cm. on chest in 15 platyrrhines = 610; in 16 catarrhine monkeys = 172; in 8 gibbons = 499; in 13 anthropoid apes = 90; and in 15 individuals of man = 1. The present data supply a basis for the interpretation of the more or less complete hairlessness of the human chest. It is found that the tendency for the chest to become denuded by supporting fewer and fewer hairs per unit of surface area is not restricted to man, but is also very pronounced in other higher primates, particularly the gorilla. In the two adult mountain gorillas there are per unit of area only 6 and 3 hairs respectively; whereas in one white man there are 9 hairs, though this was an individual who did not at all appear to possess a "hairy chest." The two adult chimpanzees, with 43 and 59 hairs respectively, have relatively bare chests when compared with, *e. g.*, a gibbon with 888 hairs. Macaques and baboons also manifest a trend toward a rather hairless chest (probably most advanced in the Gelada baboon). Among platyrrhines the spider monkey has the least density of hair on the chest, just as it has the smallest number of hairs per sq. cm. on the back and on the head. In the family *Hylobatidae* the chest hair of the siamang is much more sparse than that in juvenile or adult gibbons. The following condensed tabulation of average densities shows that the siamang stands, in regard to the density of hair in all the bodily regions studied, between the gibbons and the anthropoid apes:

	Scalp	*Back*	*Chest*
Gibbons (9)	2,035	1,727	499
Siamang (1)	718	429	251
Anthropoid apes (13)	307	276	90

This finding supports the previous conclusion of the author (1930), reached from a study of the skeleton: "There can be no doubt that *Symphalangus syndactylus* approaches the anthropoid apes . . . more closely than do the various species of *Hylobates*."

RELATIVE DENSITY OF HAIR

So far this paper has dealt only with the absolute density of hair. The question must now be discussed whether there exists any constant

relation between the densities in the different regions. For this purpose the densities on the back and on the chest have been expressed in percentage of the density on the scalp (see Tables 1 to 4). In man these percentages are practically always 0. In all the animals, listed in the tables, the relative density of the hair on the chest is without exception less than that of the hair on the back and of that on the scalp. The relative density of the hair on the back lies below 100 in 42 out of 57 cases, *i. e.*, in the large majority of the animals the hair is less dense on the back than on the scalp. The reversed relation occurs among platyrrhines only in the marmoset (*Oedipomidas*), but among the catarrhines in a variety of monkeys and apes.

Average relative densities (without fetuses):

	Platyrrhines (15)	Lower catarrhines (16)	*Hylobatidae* (9)	Large apes (13)
Back	98	98	84	92
Chest	33	21	26	34

The above average percentages show clearly that, in spite of great individual variations, there exists a general constancy in the relations between the hair densities of different bodily regions. This can be summarized by stating that on an average the hair on the back is slightly less dense than that on the head, and that the hair on the chest is always very much less dense than that on either the back or the head. This rule exists apparently also in carnivores and rodents.

TOTAL NUMBER OF HAIRS

The calculated total numbers of hairs in a particular bodily region cannot claim any great exactitude, as has already been discussed in a previous chapter. These totals, nevertheless, justify several safe conclusions of considerable interest. The following tabulation shows the average numbers (divided by 1,000) in the different groups of primates. These averages have been calculated from juvenile and adult animals only, because age differences in absolute body size, as will be shown later, influence these totals to a very considerable extent.

According to these average figures the chest (and abdomen) supports in general less hair than does the much smaller surface of the

	Scalp	*Back*	*Chest*
Platyrrhines (15)	134.1	404.5	126.5
Lower catarrhines (16)	126.5	468.9	98.3
Gibbons (7)	223.8	657.2	214.8
Siamang (1)	87.5	206.0	120.6
Large apes (9)	142.9	380.6	110.8
Man (11)	152.3	0	2.3

scalp, and the back is by far the most hairy region of the body. The platyrrhine and catarrhine monkeys and the anthropoid apes have fairly similar averages for the total numbers of hairs; namely, quite roughly 135 thousand on the scalp, 415 thousand on the back, and 110 thousand on the chest. It is of interest also that the large apes have on an average not more hair than the small monkeys. Quite generally speaking, it almost seems that the number of hairs in lower primates has in higher primates not increased, but simply spread over a much larger body surface. This is in agreement with the previous finding, that in general the density of hair is much less in the large apes than in the small monkeys. These averages, however, are of only very limited significance, because the total number of hairs fluctuates extensively within each group of primates. Among platyrrhines, *e. g.*, the large *Cebinae* and *Alouattinae* have much higher totals than the small *Callitrichidae*. Size, however, does not necessarily account for differences in these totals, as is strikingly demonstrated by the enormous differences in the total number of hairs between *Aotus* and *Saimiri*, or between *Lagothrix* and *Ateles*, which are of practically the same body size (see trunk heights). Among the *Hylobatidae* the juvenile siamang possesses infinitely less hair than the gibbons of about the same size. The total numbers of hairs vary very considerably in anthropoid apes. Adult chimpanzee has as few as 41 thousand hairs on the scalp and 102 thousand hairs on the back. Of chest hairs there are as few as 15 thousand in an adult gorilla, which is below the maximum of 21 thousand in the small series of man. The author is certain that there are white men with at least twice as many chest hairs, which would equal the 44 thousand in an adult chimpanzee.

Man's "hairlessness" is commonly regarded as a unique condition calling for special explanations, such as domestication or some form of selection. This preliminary study has furnished sufficient data to place this human condition in a different light by proving that "hairlessness"

is largely a matter of degree. A relative loss of hair has occurred in other higher primates, besides man. Man is the least hairy primate, but in this respect there exist much smaller differences between man and some apes than between the latter and the majority of the monkeys. First of all, man has many more hairs on the scalp than any of the orang-utans and chimpanzees studied. The ranges of variations in the number of chest hairs overlap in man and in the large apes. Finally, the difference between practically no hair on the human back and 100 thousand hairs on the back of a chimpanzee loses in significance alongside the ten times greater difference between this chimpanzee and, *e. g.*, a Guenon monkey with over a million hairs on its back.

SPECIFIC AND INDIVIDUAL VARIATIONS

It has been shown that very marked differences can exist in regard to the density and total number of hairs among the various families and genera of primates. In some instances it seems highly probable that there are also significant species differences (*e. g., Papio porcarius* and *Papio hamadryas*) and even racial differences (Mongolians and Whites). In many cases, however, different species are very similar in regard to the conditions discussed in this paper. Thus, the two species of *Lagothrix* are surprisingly alike, and the two species of *Saimiri* and the two of *Pithecus* differ no more than do, *e. g.*, the two specimens of *Ateles geoffroyi*. The two examples of the long-haired *Pan schweinfurthi* possess fewer hairs than the other chimpanzees of corresponding size, but, on account of the very pronounced variability among all the chimpanzees, this apparently specific difference must be regarded as still quite uncertain. It is of interest in this connection to recall the previous finding that the Hamadryas baboon, though possessing a mantle of unusually long hair, has exceptionally few hairs on the back. This indicates the possibility that very long hair does not grow very densely.

Among the platyrrhines individuals of the same species differ remarkably little from one another, thus demonstrating a fairly high degree of constancy in the density of hair in this group of monkeys. In Old World primates, on the other hand, considerable variability seems to exist within one and the same species or genus. This is particularly evident in the baboons and in the chimpanzees, and, to a lesser degree, in gorilla and in man. More data, however, are needed to support adequately the tentative conclusion that variability increases with the decrease in density of hair.

AGE CHANGES

The present data furnish some information in regard to the changes with age in the density and total number of hairs. To these data may be added the following figures by Meyer-Lierheim (1911), which represent the number of hairs per sq. cm. on the vertex and the back of primate fetuses, supposedly corresponding in state of development to a human fetus of the sixth month:

	Macaque	*Gibbon*	*Orang-utan*	*Chimpanzee*	*Man*
Scalp	1,240	546	383	400	880
Back	1,406	440	937	420	686

In *Pygathrix* and in *Pithecus* (see Table 2. *NB.* The adult macaque, No. 140, is the mother of the fetus, No. 141) the density of hair is much greater in fetal than in adult life, but the total numbers of hairs are very much higher in adults than in fetuses. The macaque fetus of Meyer-Lierheim, belonging to one of the Chinese species, shows the same density on the scalp as the author's Indian macaque, but a much higher density on the back. The gibbon fetus of Meyer-Lierheim has very few hairs per sq. cm. when compared with the author's newborn, juvenile and adult gibbons. From this it is certain that the total number of hairs in the fetus must be far below that in the newborn, which, in turn, is very much below the totals of adults. In the orang, as in the lower monkeys, the density of hair is again found to decrease with advancing age. On the back, *e. g.*, there are per sq. cm. 937 hairs in the fetus, 219 in the newborn, 198 in the infant, and 176 in the adult. The total number of hairs increases in orang, as in the previously mentioned primates, from birth to maturity. This (postnatal) increase is so enormous that no technical inaccuracies could ever account for it. On the scalp the total increases from 32 thousand in the newborn to 72 thousand in the adult, and on the back from 38 thousand in the former to 476 thousand in the latter! The figures for chimpanzee vary so extensively that it is impossible to find definite age changes in the few available records. Nevertheless, it may be pointed out that the density of scalp hair in the fetus surpasses the densities of all the older chimpanzees studied. The juvenile gorilla has much higher densities than the two adult gorillas, but the totals are smaller in the juvenile than in the adults, except those for the chest. It cannot yet be determined whether this difference in the total number of chest hairs is due to the difference in age, or to that in sex or, possibly, to that in species.

In all three human races listed in Table 4 the density of scalp hair decreases very considerably from birth to adult life, whereas the total number of head hairs increases with age. According to Meyer-Lierheim a white fetus of the sixth month has 880 hairs on a sq. cm. at the vertex and a white newborn has 646 hairs; a second count by a photographic method resulted in 948 hairs in the fetus and only 416 hairs in the newborn. The last figure agrees very closely with the 458 hairs found by the author in a white newborn. The density of scalp hair, therefore, decreases in man not only during postnatal growth but also during fetal life.

These notes can be summarized by stating that in all the primates for which records are available, except in the gibbon, the density of hair decreases with advancing age and in every one the total number of hairs increases very markedly from fetal to adult life. The decrease in density could be explained simply by assuming that with growth an ontogenetically constant number of hairs becomes spread over a steadily increasing area. Such an assumption, however, is contradicted by the finding that the total number of hairs is continually added to until it becomes in some instances ten and more times greater in adults than in newborns. Since this problem is complicated by the fact that one deals with different generations of hair at the various stages of growth, it will merely be stated for the present that on a given bodily region there are always many more hairs at and near the completion of growth than exist around the time of birth.

SUMMARY

The density of hair is expressed by the number of hairs on a sample area of one square centimeter of skin from a definite location. This density has been studied on the scalp, back and chest in 73 embalmed specimens. The total number of hairs in a given region is calculated by multiplying the number of hairs on the sample square centimeter by the number of square centimeters in the total area of the region. In the material selected for this study it is impossible to demonstrate, by comparison with wild-shot specimens, any significant effect of captivity upon the density and total number of hairs.

Neither the density nor the total number of hairs of any primate is as great as that of the cat. Many primates do not in these respects surpass even the small prairie dog. From this preliminary and scant

comparison the order of primates, or at least the suborder of *Simiae*, does not seem to be a very hairy group of mammals. The densest coat of hair in primates is found in the platyrrhine genera *Aotus* and *Lagothrix* and in the catarrhine genera *Lasiopyga* and *Hylobates*. An evident reduction of hair has occurred in the spider monkey among New World monkeys, in macaques, some baboons, etc., among Old World monkeys, in the siamang among the *Hylobatidae*, and to a varying degree in all of the highest primates. The following tabulation of average densities shows in the clearest and briefest form that, generally speaking, the hair grows most densely on the head, somewhat less densely on the back, and by far the least densely on the chest. It is also demonstrated that in regard to the density of hair the platyrrhines and the gibbons form one extreme and the anthropoid apes and man the opposite extreme, with most of the catarrhine monkeys occupying a middle position.

Average density:	*Scalp*	*Back*	*Chest*
Platyrrhines	1,852	1,737	610
Catarrhine monkeys	910	866	172
Gibbons	2,035	1,727	499
Anthropoid apes	307	276	90
Man	312	0	1

The chest supports as a rule fewer hairs than the smaller area of the scalp. This very striking relative scantiness of hair exists on the chests of all primates, whether they are quadrupedal, as baboons, or semierect, as gibbons and large apes. The total number of hairs on the back is very much greater than that of any other region studied.

The densities and total numbers of hairs vary individually comparatively little in the New World monkeys, but vary extensively in baboons, chimpanzees, and some other Old World primates.

The density of hair decreases in general with advancing age, but the total number of hairs is very much greater in late than in early stages of growth.

The density of scalp hair in man surpasses that of most anthropoid apes and the total number of scalp hairs in man is considerably higher than in any of the orang-utans and chimpanzees studied. The density of hair on the back amounts on a rough average to 870 in Old World monkeys, to 280 in the large apes, and to practically 0 in man. In an

adult chimpanzee it is as low as 48, and in an adult gorilla as low as 109. The total number of hairs on the back is about one hundred thousand in an adult chimpanzee, but over a million in an adult Guenon. The difference between the hairlessness of the human back and the density and total amount of hair on the back of an anthropoid ape is very much smaller than the difference in these conditions between some anthropoid apes and many of the lower monkeys. The density of hair on the chest of man can be higher than the density on the chest of gorilla. The ranges of variation in the total numbers of chest hairs overlap in man and anthropoid apes. All these observations indicate that the extensive loss of hair in man is merely the most extreme manifestation of a general evolutionary trend to reduce the hairy coat of the largest primates.

There exists some evidence for the conclusion that whites and negroes possess more and denser hair on the scalp than do Mongolians.

The new observations, recorded in this paper, represent a first attempt to investigate the numerous questions connected with the complicated problem of the density of hair. For their final and more extensive interpretation many additional data are needed.

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TABLE 1

The Density and Total Number of Hairs in a Rodent, a Carnivore, and in Platyrrhine Monkeys

COLL. NO.	SPECIES	AGE	TRUNK HEIGHT (cm.)	SEX	HAIRS PER SQ. CM.:			REL. DENSITY (Scalp = 100)		TOTAL NUMBER OF HAIRS (divided by 1,000)		
					Scalp	Back	Chest	Back	Chest	Scalp	Back	Chest
H. ——	*Cynomys leucurus* *	adult	14.3	♀	2,306	2,074	978	90	42	94.4	228.3	107.7
H. ——	*Felis catus*	adult	35.0	♂	4,503	3,968	2,781	88	62	443.0	2,153.0	1,510.0
H. 74	*Callithrix jacchus* *	adult	12.7	♀	2,037	1,896	912	93	45	53.8	143.3	69.0
H. 10	*Seniocebus bicolor*	adult	10.9	♂	1,445	1,264	671	87	46	34.5	63.7	33.8
H. 236	*Oedipomidas geoffroyi* *	adult	15.0	♂	1,228	2,280	572	186	55	44.5	285.2	84.1
H. 230	*Oedipomidas geoffroyi* *	adult	15.9	♂	1,214	2,078	586	171	48	47.7	288.7	81.5
H. 8	*Saimiri sciureus*	juvenile	12.5	♂	1,898	1,651	643	87	34	93.6	138.3	53.9
H. 227	*Saimiri örstedii* *	adult	18.5	♂	2,125	1,653	564	78	27	97.4	252.3	86.2
H. 242	*Aotus zonalis* *	adult	18.9	♀	4,083	2,985	1,232	73	30	194.4	480.5	198.2
H. 238	*Aotus zonalis* *	adult	18.7	♂	3,094	2,783	1,188	90	38	136.6	499.0	213.2
H. 16	*Alouatta palliata* *	adult	26.1	♂	1,195	1,150	237	96	20	138.8	585.0	120.4
H. 52	*Alouatta palliata* *	adult	26.5	♂	1,187	1,047	198	88	17	144.3	555.7	104.9
H. 44	*Cebus capucinus* *	adult	22.0	♂	1,235	1,126	442	91	36	133.6	353.0	138.5
H. 35	*Lagothrix infumata*	adult	25.0	♂	2,546	2,398	727	94	29	346.3	920.2	278.3
H. 179	*Lagothrix lagotricha*	adult	26.5	♂	2,557	2,446	708	96	28	318.2	951.0	275.0
H. 47	*Ateles geoffroyi* *	adult	22.0	♂	1,025	705	230	69	22	121.9	302.6	98.7
H. 43	*Ateles geoffroyi* *	adult	24.0	♂	906	598	149	66	16	105.4	248.3	61.9

TABLE 2

The Density and Total Number of Hairs in Catarrhine Monkeys

COLL. NO.	SPECIES	AGE	TRUNK HEIGHT (cm.)	SEX	HAIRS PER SQ. CM.:			REL. DENSITY (Scalp = 100)		TOTAL NUMBER OF HAIRS (divided by 1,000)		
					Scalp	Back	Chest	Back	Chest	Scalp	Back	Chest
H. 192	*Magus maurus*	adult	28.7	♂	954	588	396	62	41	159.0	346.1	233.0
H. 187	*Lasiopyga pygerythra*	juvenile	18.0	♂	1,816	2,275	226	125	12	152.0	459.3	45.6
H. 256	*Lasiopyga pygerythra*	juvenile	23.1	♀	1,778	1,012	237	57	13	148.8	345.5	80.8
H. 148	*Lasiopyga pygerythra*	adult	35.2	♂	2,051	1,739	253	85	12	279.0	1,064.0	155.1
H. 193	*Cercocebus aethiops*	adult	29.0	♂	846	978	260	116	31	113.7	492.0	130.7
H. 71	*Erythrocebus patas*	adult	31.6	♀	705	1,546	129	219	18	93.8	763.0	63.6
H. 137 a	*Pygathrix germaini* *	fetus	9.6	♀	1,576	2,212	375	140	24	89.3	142.0	24.1
H. 188	*Pygathrix aurata* *	adult	35.1	♀	1,059	706	160	67	15	119.0	587.2	133.0
H. 68	*Nasalis larvatus* *	adult	35.3	♀	671	1,072	379	160	56	74.5	651.0	230.0
H. 141	*Pithecus rhesus*	fetus	8.3	♀	1,240	687	127	55	10	63.3	37.1	6.9
H. 140	*Pithecus rhesus*	adult	30.5	♀	630	619	69	98	11	89.5	330.0	36.8
H. 84	*Pithecus rhesus*	adult	32.9	♀	673	482	72	72	11	69.4	236.6	35.4
H. 26	*Pithecus speciosus*	adult	31.4	♀	654	403	36	62	6	113.4	251.3	22.5
H. 200	*Papio papio*	juvenile	25.1	♂	568	549	104	97	18	122.2	284.2	53.9
H. 254	*Papio cynocephalus*	juvenile	25.4	♂	381	405	109	106	31	68.6	200.7	54.0
H. 25	*Papio hamadryas*	juvenile	27.2	♂	487	177	53	36	11	108.4	103.6	31.1
H. 27	*Papio porcarius*	juvenile	42.5	♂	784	686	107	88	14	224.8	889.4	138.6
H. 203	*Papio neumanni*	adult	35.4	♀	497	624	162	125	33	87.8	499.0	129.5

TABLE 3

The Density and Total Number of Hairs in Gibbons, a Siamang, Orang-utans, and Chimpanzees

COLL. NO.	SPECIES	AGE	TRUNK HEIGHT (cm.)	SEX	HAIRS PER SQ. CM.:			REL. DENSITY (Scalp = 100)		TOTAL NUMBER OF HAIRS (divided by 1,000)		
					Scalp	Back	Chest	Back	Chest	Scalp	Back	Chest
H. 121 a	*Hylobates pileatus* *	newborn	10.6	♂	1,957	2,169	177	111	9	142.2	181.6	14.8
H. 125	*Hylobates pileatus* *	adult	...	♀	2,096	...	...	...	...	249.6	....	....
H. 261	*Hylobates lar*	adult	25.4	♂	2,189	1,834	359	84	16	237.0	898.0	175.6
H. 36	*Hylobates agilis*	juvenile	20.0	♀	1,633	2,030	578	124	35	172.5	601.5	171.2
H. 205	*Hylobates leuciscus*	juvenile	19.2	♀	2,047	1,226	635	60	31	206.0	371.0	192.0
H. 204	*Hylobates leuciscus*	juvenile	19.3	♂	2,244	1,630	403	73	18	254.6	455.0	112.4
H. 182	*Hylobates leuciscus*	juvenile	21.4	♂	2,017	1,896	594	94	29	205.8	609.7	190.6
H. 152	*Hylobates leuciscus* *	adult	25.2	♂	2,093	1,858	888	89	42	210.5	905.0	432.0
H. 189	*Hylobates leuciscus* *	adult	28.9	♂	2,043	1,174	355	57	17	254.0	760.1	229.7
N. 255980	*Symphalangus syndact.*	juvenile	24.8	♂	718	429	251	60	35	87.5	206.0	120.6
N. 153825	*Pongo pygmaeus* *	newborn	12.9	♀	239	219	23	92	10	31.8	38.0	4.0
N. 153826	*Pongo pygmaeus* *	infant	14.8	♂	256	198	31	77	12	37.8	43.3	6.8
H. 212	*Pongo pygmaeus*	adult	49.8	♂	158	176	107	111	68	71.8	476.0	289.0
H. 217	*Pan* (species?)	infant	24.1	♂	307	561	159	183	52	69.6	300.0	84.9
H. 264	*Pan schweinfurthi*	infant	24.5	♂	219	173	140	79	64	47.9	102.5	82.9
H. 215	*Pan* (species?)	juvenile	25.8	♂	337	483	98	143	29	77.5	270.0	54.9
H. 214	*Pan* (species?)	juvenile	30.2	♂	298	490	112	164	38	74.4	369.0	84.2
H. 267	*Pan schweinfurthi*	juvenile	30.2	♀	237	229	186	97	78	66.0	176.6	142.7
H. 206	*Pan* (species?)	sub-adult	46.4	♂	258	153	115	59	45	101.3	273.3	205.4
H. 295	*Pan* (species?)	adult	47.8	♀	112	48	21	43	19	40.7	101.8	44.5

		adult	47.8	♀	112	46	21	43	19	40.7	101.8	44.5

TABLE 4

The Density and Total Number of Hairs in Gorilla and Man

COLL. NO.	SPECIES	AGE	TRUNK HEIGHT (cm.)	SEX	HAIRS PER SQ. CM.: Scalp	Back	Chest	REL. DENSITY (Scalp = 100) Back	Chest	TOTAL NUMBER OF HAIRS (divided by 1,000) Scalp	Back	Chest
A. 1216	*Gorilla gorilla*	juvenile	28.1	♀	685	603	172	88	25	208.2	458.0	130.7
C. A. 2	*Gorilla beringei* *	adult	68.6	♂	469	109	6	23	1	347.5	556.0	30.6
C. A. 1	*Gorilla beringei* *	adult	72.3	♂	411	145	3	35	1	298.5	745.0	15.4
H. ——	*Homo sapiens* (Negro)	newborn	...	♀	434	0	0	0	0	113.6	0	0
H. ——	*Homo sapiens* (Negro)	2 years	...	♀	439	0	0	0	0	147.3	0	0
H. ——	*Homo sapiens* (Negro)	50 years	...	♀	219	0	0	0	0	100.6	0	0
H. ——	*Homo sapiens* (Negro)	adult	...	♂	312	0	0	0	0	173.4	0	0
H. ——	*Homo sapiens* (Negro)	adult	...	♂	298	0	0	0	0	162.1	0	0
H. ——	*Homo sapiens* (Negro)	32 years	...	♂	341	0	0	0	0	191.7	0	0
H. ——	*Homo sapiens* (Negro)	45 years	...	♂	308	0	0	0	0	178.8	0	0
H. ——	*Homo sapiens* (Negro)	40 years	...	♂	302	0	0	0	0	164.3	0	0
P. A. L. 22	*Homo sapiens* (Hawaiian)	31 years	53.9	♂	216	0	0	0	0	105.2	0	0
H. 253	*Homo sapiens* (Chinese)	newborn	...	♂	224	0	0	0	0	64.2	0	0
P. A. L. 23	*Homo sapiens* (Chinese)	40 years	47.8	♂	128	0	0	0	0	71.8	0	0
H. ——	*Homo sapiens* (White)	newborn	...	♂	458	0	0	0	0	90.5	0	0
H. ——	*Homo sapiens* (White)	45 years	...	♀	401	0	0	0	0	200.0	0	0
H. ——	*Homo sapiens* (White)	adult	49.0	♂	311	0	2	0	1	158.6	0	4.3
H. ——	*Homo sapiens* (White)	33 years	50.3	♂	288	0	9	0	3	168.9	0	20.7

SOME PHASES OF HUMAN BIOLOGY IN KOREA (CHOSEN)*

BY THOMAS J. LE BLANC

Korea, or Chosen as it is now called, is a large peninsula projecting from the mainland of Asia, its long axis lying almost due north and south between L 33 6′ 40″ N and 43 00′ 36″ N while the east and west limits fall between L 124 11′ E and 130 56′ 23″. This geographic orientation combined with certain topographical features is of interest from a biologic standpoint and will be referred to later. The area of Korea is 85,228 square miles which is only about 2,000 square miles less than the area of the main island of Honshu. Eastward is the Sea of Japan, the southern end is washed by the Strait of Chosen while the western side faces the Yellow Sea. The peninsula is separated from Manchuria by a fairly well defined natural boundary made up of the Changpai Range and the Yalu and Tumen rivers. The range slopes southward to end in a steep scarp on the shore of the Sea of Japan. The rugged topography and altitude characteristic of this northern region gives it a severe winter climate indicated by some districts having January isotherms as low as —18 C. Extending south through the eastern part of the peninsula is a mountainous backbone sloping steeply to the Sea of Japan and dipping less abruptly towards the Yellow Sea, making a gently rolling country traversed by many large streams which have extensive flood plains supporting many towns and villages.

The position of Korea with reference to the Eastern Powers that are her neighbors has placed her in the past under varying degrees of strain induced by forces emanating from Russia, China and Japan. This has produced an unsettled history barren of any reliable records that might be of use to the student of the biology of the Korean people. The Treaty of Portsmouth concluded on September 5, 1905 at the termination of the Russo-Japanese War recognized Japan's paramount political, military and economic interests in Korea and finally on August 23, 1910

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the Korean Territory was formally annexed to the Empire of Japan and up to the present (1930) the situation remains unchanged. Whatever one may think of this arrangement, to the human biologist its important feature is, that under Japanese rule demographic statistics are collected frequently and accurately and this was apparently not true of any time in the past. Thus the discussion of various rates will, of necessity, be confined to the time from 1910 onwards.

Only an approximation can be given of the racial elements that contributed to the formation of the present-day Koreans. If one accepts Deniker's [1] definition of Mongols as being straight haired with pale yellow skins, prominent cheek bones, Mongoloid eye and slight brachycephaly, then the Koreans are essentially Mongol in characteristics. This is plainly a harmless generalization and it is possible to be a little more specific by saying that the more immediate components of the Koreans are Manchu and Chinese. Any further analysis at the present time would have a large element of speculation and would be in the nature of an intrusion into the domains of anthropology and ethnology.

In physical appearance the Korean differs somewhat from the Japanese. They have never had a system of compulsory military service, so we do not have measurements that come from the operation of such a system nor has any exhaustive series of measurements been collected by anthropologists. However, Pittard [2] quotes the height of Koreans at 163 centimeters, which indicates that they are or were taller than Japanese. No mention is made of the time to which this value applies so it is not only possible but probable that a change has taken place since the measurements were made. The greater height of the Koreans seems to be confirmed by superficial observation in the face of the fact that the Korean footgear is a soft slipper that adds nothing to the wearer's height whereas in Japan an appearance of height is given by the wooden clogs or *geta*. The majority of Japanese appear an inch and a half to two inches taller on rainy days than on clear days because of the different *geta* worn in different weather. One is also struck by the erect carriage of the old people in Korea, which in general is not true of the old persons in Japan. In any of the large cities such as Seoul (Keijo) one sees an unbelievable number of very old men strolling about the streets in pairs or in groups and every one is tall and straight and carries himself with a strikingly easy stride. In addition it appears,

[1] Essai d'une classification des races humaines. *Bull. Soc. d'anthropol. Paris*, 1889.
[2] Race and History. E. Pittard, A. A. Knopf, 1926, Eng. Trans. p. 408.

and this may only be apparent, that there is a greater difference between Korean men and women than there is between the Japanese men and women. Korean women look very diminutive beside Korean men and one is almost led to wonder if the two came from the same racial stock.

POPULATION

Since figures are available for only 16 years little can be said of population growth except that between two census years 1920 and 1925 there was an increase of 2,258,826 persons. Using the population of 1920 as a base this increment represents a rate of increase of 13.1 per cent for the five years or 2.6 per cent per year. In Japan proper the population increased 7.1 per cent or 1.4 per cent per year, a rate of increase only approximately half that of Korea. The density of population averages about 230 persons per square mile of total area but varies considerably from almost zero in some of the northern provinces

TABLE 1

Showing the Population of Korea (Chosen) by Sex, Sex Specific Death Rates and the Ratio of Males to Females for the Years Indicated. The Years 1920 and 1925 are Census Years

YEAR	TOTAL POPULATION IN THOUSANDS	MALES IN THOUSANDS	MALE DEATH RATE PER THOUSAND MALES	FEMALES IN THOUSANDS	FEMALE DEATH RATE PER THOUSAND FEMALES	MALES PER HUNDRED FEMALES
1910	13,313	7,057	8.5	6,255	8.1	112
1911	14,056	7,398	12.1	6,658	11.6	111
1912	14,827	7,732	16.3	7,095	15.6	108
1913	15,459	8,033	18.3	7,426	17.7	108
1914	15,930	8,259	20.0	7,671	18.9	108
1915	16,278	8,371	22.6	7,907	19.5	106
1916	16,648	8,575	24.2	8,073	20.3	106
1917	16,969	8,747	25.4	8,222	22.8	106
1918	17,057	8,790	31.2	8,267	30.2	106
1919	17,150	8,836	23.8	8,314	21.9	106
1920	17,264	8,903	23.7	8,361	23.1	106
1921	17,453	8,998	20.2	8,455	19.3	106
1922	17,627	9,089	22.0	8,538	20.8	106
1923	17,885	9,214	21.1	8,671	19.9	106
1924	18,068	9,294	22.2	8,774	20.7	106
1925	19,523	10,021	20.9	9,502	19.2	105

to three or four times the average in the southern part and along some of the river flood plains. Much of the country is mountainous and not available for agriculture so that population density is considerably higher per unit of arable land. This fact and the rate of increase of the population are significant in connection with the suggestion that is often made that Korea can act as an expansion zone for the Japanese population. Figures for population are given in Table 1. It will be noted that the ratio of males to females shows a fairly well marked decline even though the period under observation is relatively short. This may be a real difference brought about by the cumulative effect of a consistently lower death rate among females or it may be simply the effect of better census

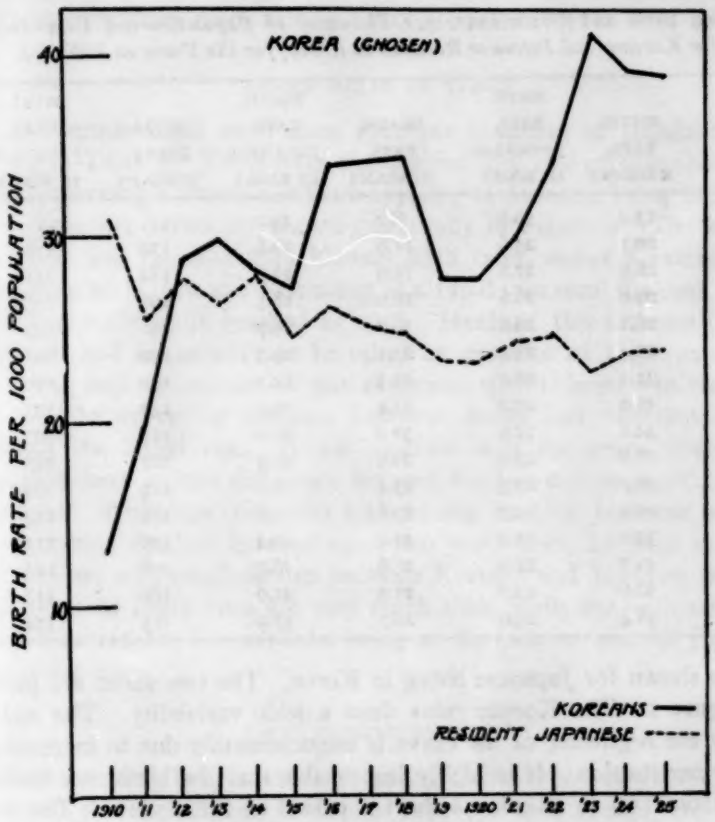

FIG. 1. BIRTH RATES OF KOREANS AND OF JAPANESE RESIDENT IN KOREA

methods that would tend to increase the counting of women who under more lax methods would have been overlooked. A certain amount of evidence supporting the latter conclusion is seen in the difference between the ratio of males for 1910 and 1912, a period when registration and counts were first being instituted. In these three years the ratio dropped 4 points whereas in the next thirteen years it only fell 3 points.

BIRTH RATES BY YEARS

The birth rate per thousand of population for the years 1910 to 1925 is shown in Table 2. For purposes of comparison the corresponding

TABLE 2

Showing Birth and Death Rates per Thousand of Population and Vital Indices for Koreans and Japanese Resident in Korea, for the Years as Indicated

YEAR	BIRTH RATE, KOREANS	BIRTH RATE, JAPANESE IN KOREA	DEATH RATE, KOREANS	DEATH RATE, JAPANESE IN KOREA	VITAL INDEX, KOREANS	VITAL INDEX, JAPANESE IN KOREA
1910	13.4	30.9	8.2	19.0	...	...
1911	20.1	25.6	11.8	18.6	170	138
1912	28.9	27.8	15.9	19.7	182	141
1913	29.8	26.6	18.0	18.5	166	143
1914	28.1	28.6	19.2	19.7	146	145
1915	27.4	24.4	21.1	19.7	130	124
1916	33.9	26.2	22.3	22.1	152	119
1917	33.9	25.2	24.2	20.5	140	123
1918	34.1	24.9	30.9	24.0	111	103
1919	27.8	23.3	22.9	21.9	121	107
1920	27.7	23.3	23.4	26.1	119	89
1921	29.9	24.3	19.8	19.6	151	124
1922	34.0	24.7	21.4	22.4	159	111
1923	40.7	22.9	20.6	18.9	198	121
1924	38.6	23.7	21.5	21.0	180	113
1925	38.4	24.0	20.7	17.9	185	134

rate is shown for Japanese living in Korea. The two series are plotted in Figure 1. The Korean rates show a wide variability. The sudden rise at the beginning of the curve is unquestionably due to increasingly better registration. It is highly improbable that the birth rate actually rose from 13.4 to 28.9 in as short a period as three years. The rates for Japanese persons resident in Korea are much less variable and there is no evidence of any marked change in completeness of registration.

Both trends show evidence of the influenza pandemic of 1918, the Korean being more marked in this respect. In 1919 the rate fell from its previous level of 34.1 to 27.8 and it did not return to its former position until 1922. But the most important feature of the two sets of rates is that the Korean rate is increasing quite rapidly. A straight line fitted to the observed points has a slope constant of + 1.15. At the same time the birth rate of Japanese in Korea is decreasing at the rate indicated by a slope constant of — 0.36. Whatever may be the reasons for this difference the essential fact is that Japanese who emigrate to Korea show a steadily declining birth rate whereas the indigenous population exhibits a relatively rapidly increasing birth rate. This relationship by itself is not so significant but when it is viewed in conjunction with the respective death rates it becomes noteworthy.

DEATH RATES BY YEARS

The crude death rates since 1910 per thousand of population are shown in Table 2. These were also divided into two groups, those that obtained among Koreans and those applying to Japanese living in Korea. The respective values are shown graphically in Figure 2. The Korean curve, as was the case with Korean birth rates, shows a marked rise beginning with 1910 and continuing at a rapid rate until the peak of the influenza outbreak is reached in 1918. Much of this increase is only apparent and is probably to be taken as evidence of improvement in reporting and registration as was suggested with reference to the birth rates. The curve for resident Japanese shows less variation and is without the initial rise. If we consider only the years from 1917 onwards there is little difference between the two curves in either level or trend. While mortality was high among resident Japanese in 1918 it apparently reached its maximum two years later, i.e. 26.1 in 1920. In brief we may conclude that between Koreans and Japanese resident in Korea, the death rates are very much alike, while the birth rates are quite different, the Korean rates being on the increase and the Japanese on the decrease.

VITAL INDICES BY YEARS

The next step is to combine births and deaths into a single numerical measure, the vital index. This was done for both groups, the values being given in Table 2 and shown in Figure 3. A glance at the figure indicates that the vital index for Koreans is *always* higher than the one

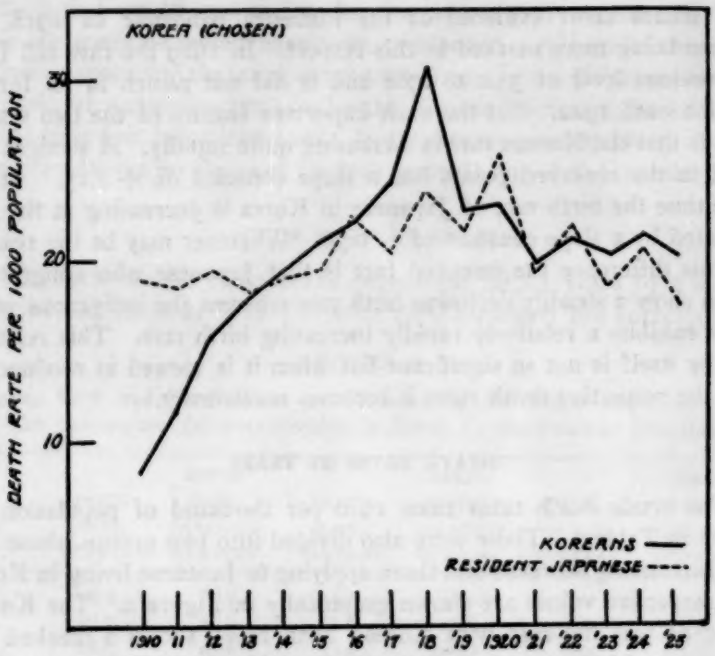

FIG. 2. DEATH RATES OF KOREANS AND OF JAPANESE RESIDENT IN KOREA

for resident Japanese. As would have been expected from considering the respective death rates the Korean vital index falls lowest in 1918 and the Japanese index reaches its lowest level in 1920. The Korean index recovers rapidly, soaring to 198 in 1923, and in 1925, the last year recorded, it is still at 185. The Japanese points have a descending slope (— 1.85) while the Korean has an ascending slope of about the same magnitude (+ 1.01). Thus the Korean population is increasing very rapidly, whereas not only are resident Japanese increasing much more slowly but the rate of increase is decreasing so that if the present trend continues for a decade or so, resident Japanese will not even be maintaining their own numerical level. A clear understanding and an appreciation of this fact might serve to lessen the enthusiasm of those persons who see in Korea the solution of the problem of population pressure in Japan.

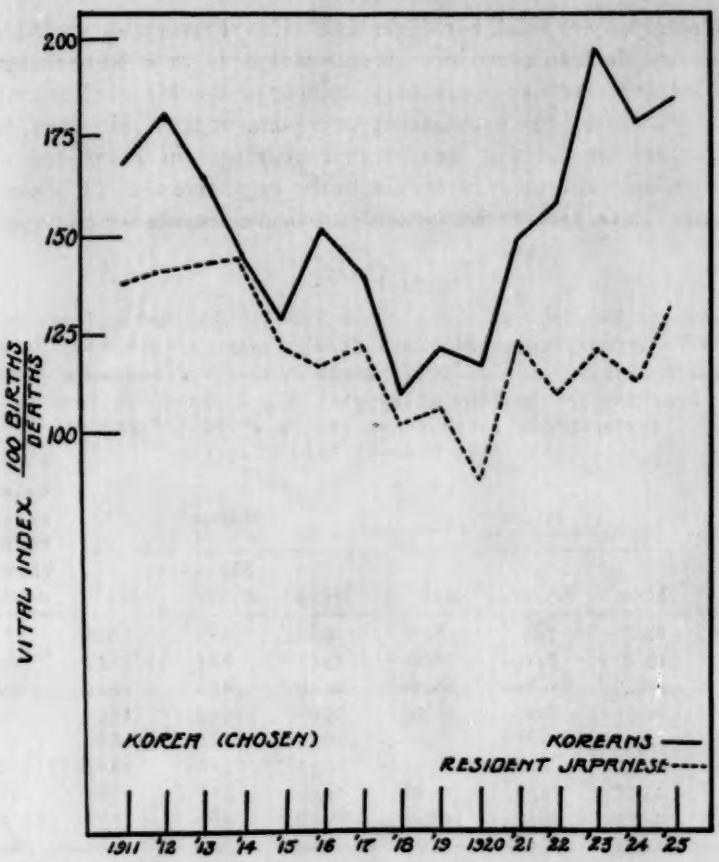

FIG. 3. VITAL INDICES OF KOREANS AND OF JAPANESE RESIDENT IN KOREA

AGE AT MARRIAGE

For some unknown reason there is a rather widespread belief that in most Korean marriages the bride is older than the groom. Some Koreans subscribe to this and explain it by saying that the duties of a Korean housewife are manifold, and require a degree of skill and training that can only be acquired after a period of years. Thus a man who married a relatively young woman would be exposing himself to the risk of taking an incompletely and improperly trained mate and conversely, the older the bride is, the better are the chances that she will

be able properly to fulfill her duties as a wife. Presumably according to this theory, the man's activities are such that he is prepared to undertake them without extensive preliminary training or else his intelligence is so superior that he attains proficiency at a younger age. However, when we examine the facts it appears that marriages in Korea are much like marriages elsewhere in respect to the respective ages of brides and grooms. Table 3 shows the various statistical constants for all registered

TABLE 3

Showing the Mean Age at Marriage, the Standard Deviation in Years and the Modal Age for Registered Marriages Among Koreans for Males and Females Respectively and the Number of Married Persons per Thousand of Total Population for the Years as Indicated. The Constants are Based on Frequencies of About 120,000 and the Probable Errors are of the Order of ± .01 or Less

YEAR	MALES			FEMALES			MARRIED PERSONS PER 1000 OF POPULATION
	Mean	Sigma in years	Mode	Mean	Sigma in years	Mode	
1912	23.27	7.37	18.75	19.66	6.56	17.48	251
1914	23.27	7.02	18.82	19.67	6.24	17.59	240
1915	25.17	9.55	18.76	20.58	8.98	17.25	235
1920	22.55	6.66	18.54	19.61	4.93	17.94	259
1921	22.75	6.67	18.65	19.68	4.88	18.00	260
1922	20.53	6.70	18.84	19.75	4.98	18.04	260
1923	23.28	6.74	19.01	19.97	4.88	18.10	255
1925	22.65	6.47	18.61	19.62	4.80	17.97	251
1926	22.69	6.53	18.65	19.64	4.80	17.99	251

marriages among Koreans for the years for which the necessary data are available, and from this we see that judging from the respective mean ages the groom is generally about three years older than the bride. This difference is decreased to one year if we regard the modal ages. These differences are borne out if we examine a correlation table between age of bride and groom for any one year. There are the usual number of weddings between the Mays and Decembers of life, but in general the above mentioned differences are maintained. In addition to the relative age for bride and groom the table shows that there has been no marked change in the age at marriage for either males or females between the years 1912 and 1926. This same thing is true of the age at marriage in Japan. Compared to the Japanese, the Korean male is

about 6 years younger at marriage while the Korean female when she becomes a silent bride is about 3 years younger than her Japanese sister. This difference in the age at marriage between Koreans and Japanese may account in part for the higher rate of increase of the former. Another point exhibited by the table is the decrease in the degree of dispersion as measured by the standard deviation. This is shown by both the constants for males and for females, which means that as time goes on the ages at marriage tend to group themselves closer to the mean value. This was not found to be true of all marriages in Japan but did apply to *first* marriages there. It is likely that this is evidence that the age at marriage is tending to become stabilized at what may be termed a temporary upper level and if this is the case the upper level among Koreans is lower than that for Japan, a rather unexpected situation since the standard of living is probably lower in Korea than in Japan. However if such a stabilization does occur it may be but temporary and later the upper limit may advance until it becomes much like the corresponding value for Japanese. Finally there is to be noted the definite disturbance that took place in both the mean and standard deviation for males and females for 1915. The mean was advanced in each case and the standard deviation increased by 30 per cent. Examination of the frequencies shows that this was caused by a marked increase in the number of marriages registered and especially those in the older age groups. It is impossible to say just what brought this about. It might have been an increased activity on the part of police officials or some judicial decision that affected property rights among married persons, its action depending on whether or not the marriage had been registered. Whatever it was caused the flurry in registration, it had disappeared by 1920 when all constants returned more or less to their former positions. One significance of this disturbance is that it raises the question as to whether registry, police supervision and vital statistics are as accurate as the authorities believe them to be.

SOME RELATIONS BETWEEN GEOGRAPHY AND VITAL PHENOMENA

The topography of Korea together with its orientation in a northerly and southerly direction causes the climate in the northern portion to differ from that in the southern part. This is especially true of winter climate when the prevailing winds sweep across from Manchuria to strike the mountain range along the northern border, resulting in January isotherms as low as — 18°C. In the extreme south the January isotherm

ranges between + 2°C. and +3°C. Thus there is a difference of 21°C. between the winter temperatures of north and south. This same degree of difference between the two regions is also manifested by the beginning of winter and spring, winter beginning earlier in the north and spring approximately a month later than in the south. On the other hand the summer climate is tempered by sea breezes so that there is not so marked a difference between north and south. In the former the August isotherm is in the neighborhood of 22°C. while in the latter it is about 26°C., a difference of only 4°C. And so it may be said that the broad climatic differences between north and south Korea are confined to the winters, the summers being essentially alike, except that in the north they are somewhat shortened. Since both winter climate and topography in the north are noticeably different from the south we may put the question: Are there significant differences between the two regions in such vital phenomena as births, deaths and vital indices? The data for such an inquiry are made available by an official publication of the Korean Government.

First birth rates may be considered. If we map the birth rates by *guns*,* a political division corresponding to a county, using green for low rates, i.e. 20-24 per thousand of population, and red for high rates, 50-53, the most striking feature of such a map is at once apparent. There are no *green* areas in the north and no *red* areas in the south. In short the north shows exclusively *high* birth rates while the south shows exclusively *low* birth rates, both being understood in a relative way. There is one exception to this in the north, a small urban area which happens to be included in one of the *guns*. If we repeat this process using death rates and mapping them with the same colors, green denoting death rates 10-14 per thousand and red 26-31, the same facts make themselves apparent. There are no green areas in the north and no red areas in the south, so that high death rates are to be found in the northern region and low death rates are confined exclusively to the southern region. Inspection of such maps shows that the northern zone is separated from the southern one by a middle zone in which is found a mixture of both high and low rates, or rather a shading from high rates in the north to low rates as we progress southwards. This led to a division of the country into three zones for the purpose of study. The zones were established for the sake of simplicity by the parallels of north

* The birth rates and death rates for the individual *guns* are not printed here, but may be obtained from the author by those interested.

latitude 36 and 38. Purely by chance apparently, these two parallels limit rather accurately the three zones from the standpoint of biologic phenomena. It would also be possible to define the zones on the basis of January isotherms, in which case —7°C. and — 3°C. would be substituted for the parallels 38 and 36, and the division on the basis of isotherms would correspond fairly accurately to the different groupings of rates. Unquestionably a more accurate limitation than the parallels

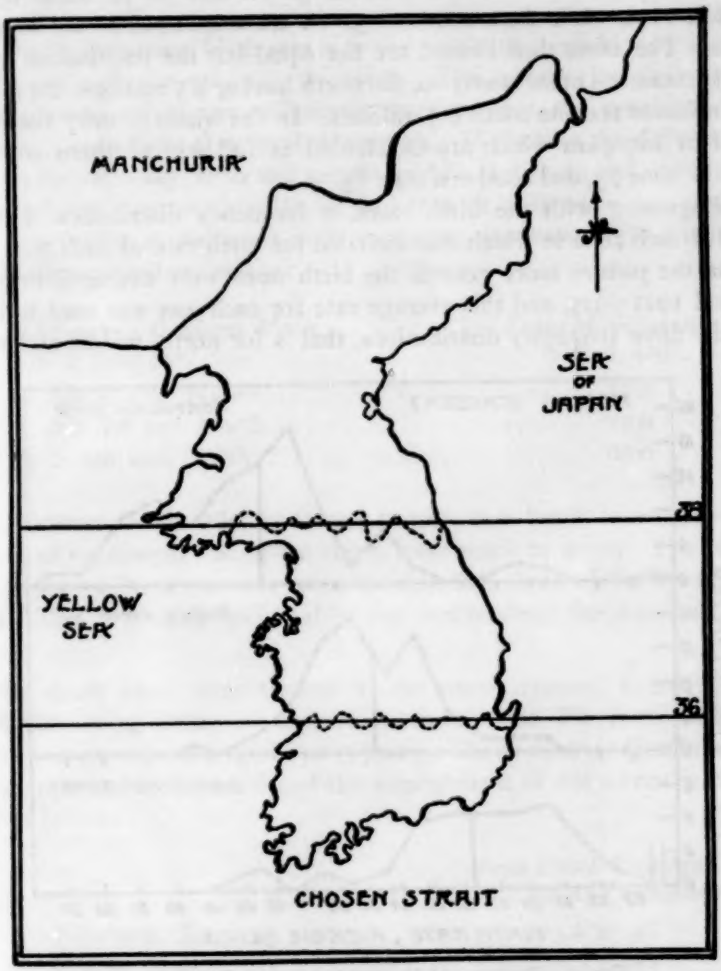

FIG. 4. MAP OF KOREA, SHOWING THE BOUNDARIES OF THE THREE ZONES DISCUSSED IN THE TEXT

of latitude could be set up, but the differences are sufficiently striking even under this rather broad and general delineation. Reference to the map, Figure 4, shows the three zones that are to be discussed. The solid horizontal lines are the parallels of latitude, while the dotted lines represent the actual boundaries of the *guns*. It will be seen that again by chance, the boundaries of the *guns* follow the parallels of latitude with reasonable accuracy. All *guns* north of 38°N. latitude constitute the northern zone, those that lie between 38°N. and 36°N. make up the middle zone, while those south of 36°N. are considered as the southern zone. The areas thus limited are not equal but the populations in the three zones are more nearly so, the north having 4.5 millions, the middle 5.9 millions and the south 8.5 millions. In the whole country there is a total of 229 *guns* which are distributed as follows: northern zone 93, middle zone 73, and southern zone 63.

Beginning with the birth rates, a frequency distribution was set up for each zone in which was included the birth rate of each *gun*. To make the picture more general the birth rates were averaged over the period 1921-1925, and this average rate for each *gun* was used to build up the three frequency distributions, that is for north, middle and south

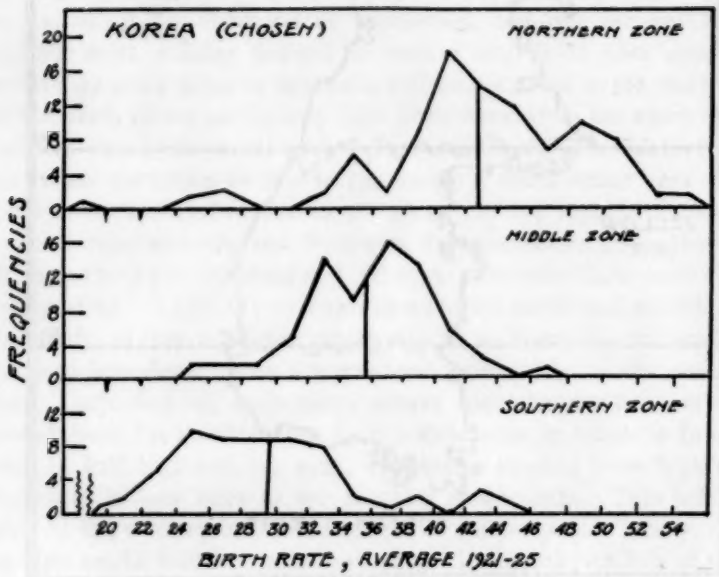
KOREA (CHOSEN)
NORTHERN ZONE
MIDDLE ZONE
SOUTHERN ZONE
FREQUENCIES
20 16 12 8 4 0
16 12 8 4 0
12 8 4 0
20 22 24 26 28 30 32 34 36 38 40 42 44 46 48 50 52 54
BIRTH RATE, AVERAGE 1921-25

FIG. 5. FREQUENCY DISTRIBUTIONS OF BIRTH RATES FOR THE THREE ZONES

in the zones as defined. The result is shown in Figure 5 and may be summarized as follows:

	Mean Birth Rate per Thousand of Population
Northern Zone	42.7 ± .43
Middle Zone	35.8 ± .33
Southern Zone	29.6 ± .47

Thus the highest mean birth rate is in the north, the next highest in the middle, while the lowest is in the south. The frequencies giving rise to these mean values are sufficiently large so that the constants are stable as is seen from their probable errors. If we take the differences between the rates say north and middle, middle and south and north and south and test them statistically we find that all differences are significant. Beginning at the south and proceeding northwards the findings may be summarized as follows:

Difference Between Mean Birth Rate for:	*Ratio of Difference to P. E. Diff.*
South and Middle	11.0
Middle and North	12.0
North and South	20.0

The difference is not only significant in each case but it becomes more marked as we compare the three zones from south to north. The birth rates in the northern zone are more variable than those of the other two zones. This is roughly indicated by the ranges along the x axis in the figure.

The death rates were treated in the same manner, a frequency distribution being set up for each of the three zones. The rates, as with the birth rates, were averaged over 5 years. The frequency distributions are diagrammed in Figure 6 and the arrangement of the means is indicated as follows:

	Mean Death Rate per Thousand of Population
Northern Zone	25.2 ± .26
Middle Zone	22.3 ± .26
Southern Zone	17.0 ± .24

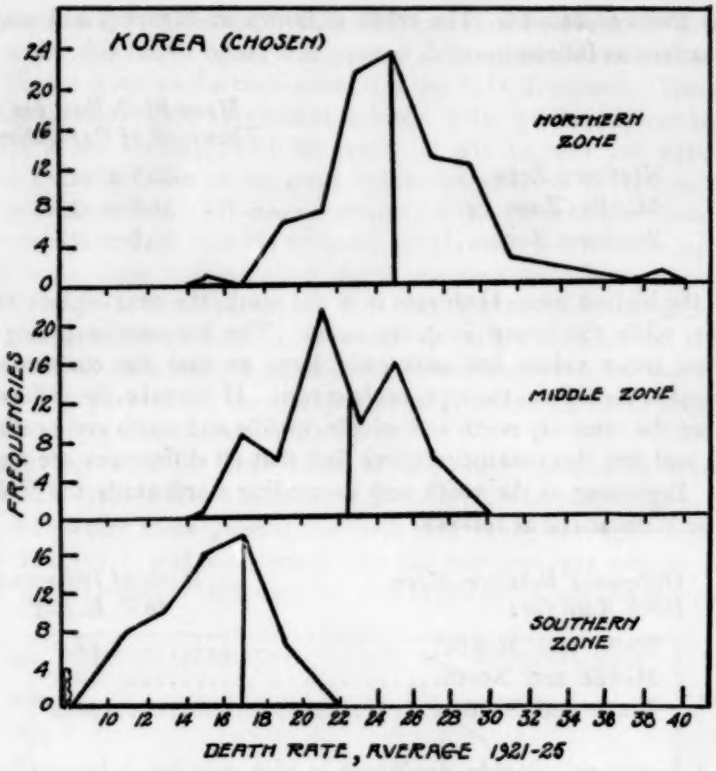

FIG. 6. FREQUENCY DISTRIBUTIONS OF DEATH RATES FOR THE THREE ZONES

Although the differences are not quantitatively as great, it is evident that the mean death rates arrange themselves in the same order as the birth rates, namely high in the north, low in the south, with the rate for the middle zone falling between these two extremes. There is also a further parallelism in the variability, which is highest in the north and lowest in the south. Testing the statistical significance of the differences in mean death rates of the various zones we get the following results:

Difference Between Mean Death Rate for:	*Ratio of Difference to P. E. Diff.*
South and Middle	15.0
Middle and North	8.0
North and South	25.0

All of the differences are significant and the death rates resemble the birth rates in that the most significant difference is that between north and south.

At this point it may be well to call attention to certain attributes of the frequency distributions for births and deaths in the middle zone. Reference to the figures where these frequencies are diagrammed shows that in both births and deaths the frequency polygon for the middle zone exhibits a distinct bi-modality. That is, there are *two* high points in the distribution separated by a well defined notch. In the birth rates the first mode falls at about 33 per thousand and the second at 38. In deaths the first mode is in the neighborhood of 21 per thousand and the second at about 25. A spot map of the respective rates shows that the middle zone does not shade evenly from low rates in the south to high rates in the north, but rather that the high rates extend down the eastern half of the zone while the low rates are distributed up the western side. Such an arrangement results in a bimodal distribution. The high rates, characteristic of the northern zone, found in the eastern half of the middle zone are grouped over a topography that is an extension of the northern region, rugged and mountainous. On the other hand the low rates, characteristic of the extreme south, run up the western half of the middle zone, over a topography of low rolling country and flood plains, a continuation of the character of the southern tip of the peninsula. Thus it would be possible to divide the middle zone into two halves on the basis of either births or deaths, by a line running north and south down the middle of the zone. The significance of this is not that it can be done, but rather the consistency with which a certain topography is associated with a specific level in either the birth rate or death rate, at least in Korea between the years 1921 and 1925.

We have seen that there are significant differences in births and deaths in the three zones and it now remains to be seen if these differences are maintained in the ratio between births and deaths. Accordingly, in each zone the births and deaths were converted into a vital index, the values being the average of five years. The resulting frequencies are plotted in Figure 7. Immediately we see that the orderly difference that existed between births and deaths has largely disappeared. The frequency polygons arrange themselves almost directly above each other, the ranges are about the same and the respective means fall very close to a single perpendicular line, all three falling in

the same group, 160-180. In addition the bi-modality of the middle zone is no longer apparent. The exact mean values are as follows:

	Mean Vital Indices
Northern Zone	177 ± 2.13
Middle Zone	162 ± 1.97
Southern Zone	176 ± 2.51

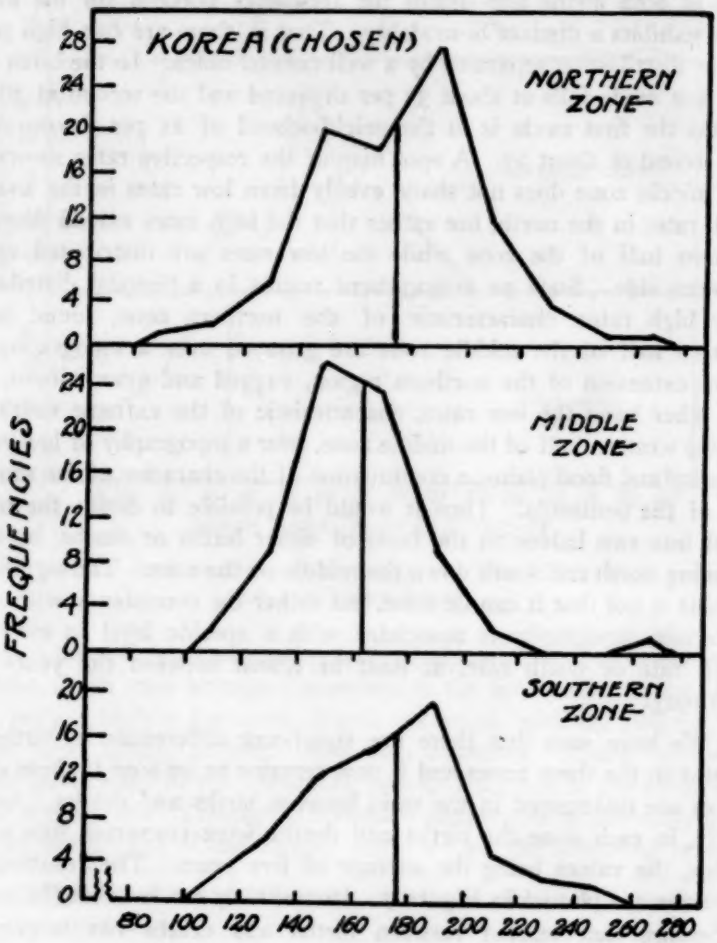

FIG. 7. FREQUENCY DISTRIBUTIONS OF VITAL INDICES FOR THE THREE ZONES

If we test the differences for statistical significance we get the following results:

Difference Between Mean Vital Index for:	*Ratio of Difference to P. E. Diff.*
South and Middle	3.2
Middle and North	5.2
North and South	0.3

It is evident that none of the differences is markedly significant but it is interesting to note that the difference between the mean vital index for north and south is certainly *not* significant, although these two regions showed the greatest differences in their respective birth and death rates. This is an excellent example of two different biologic situations having the same end result. The northern zone is characterized by high birth rates and high death rates and the southern zone shows low birth rates and low death rates, yet between the two there is no significant difference in the net result as measured by the ratio of births to deaths. It is also noteworthy that the middle zone having medium birth rates and medium death rates falls below either of the other two in its vital index.

Faced with such a definite distribution of vital phenomena as exhibited by Korea one immediately wonders if this might not be the result of a distribution of people of different races having different standards of living. Such a suggestion seems pertinent and one could set up a fairly reasonable sounding theory in which the low rates in the south were attributed to a Japanese infiltration, the medium rates of the middle zone being furnished by a population preponderantly Korean, while the high rates of the northern zone could be said to come from a population dominated by Manchu blood. The respective standards of living of such groups would be consonant with the findings in birth and death rates, since the Japanese standard of living is higher than the Korean and this, in turn, is probably higher than the Manchu. One might even go further and show that the difference in standard of living between Japanese and Koreans is greater than the difference between Koreans and Manchus and this is exactly paralleled by the death rates, the difference between the mean death rate for the southern and middle zones being greater than that between the middle and the north. Wars have been declared on evidence less convincing.

However, when we examine the racial constitution of the population in the three zones we find that the theory, however attractive it may be, has the great defect of not applying to Korea. Every zone contains over 97 per cent Koreans and there is no marked difference between the different zones in the distribution of the remaining 3 per cent. Racially the zones are almost identical. The percentage distribution of peoples in the three zones is shown in Table 4. It is evident that

TABLE 4

Percentage Composition by Race, of the Three Zones in Korea, 1925

	NORTH	MIDDLE	SOUTH
Koreans	97.30	97.04	97.77
Japanese	2.07	2.65	2.12
Chinese	0.62	0.30	0.11
All Others	0.01	0.01	0.00

there is no difference in the distribution of the various races great enough to enter into any explanation of the differences existing in the vital phenomena.

Another characteristic of the three zones that is almost entirely determined by topography is the density of population. This is lowest in the north and highest in the south. Computed on the basis of total area the densities are as follows:

	Persons per Square Ri	*Birth Rate per 1,000*	*Death Rate per 1,000*
Northern Zone....	740	43	25
Middle Zone.....	1,426	36	22
Southern Zone....	2,148	30	17

The birth and death rates are included because the table shows in a crude way an association between density of population and birth and death rates. While the values as they stand are measures of the roughest kind, nevertheless it is interesting to see that a low birth rate is associated with a high density and *vice versa,* which is in accordance with what was found in Japan by the method of partial correlation. The same relationship is suggested by the death rates, the higher one being paired with the lowest density and the lower one with the highest density. This then is another shred of evidence to be added to that already accumulated which indicates that Farr's Law is not now operating.

In concluding this discussion it seems a fair statement to say that in Korea there are definite differences in vital phenomena between north, middle and south. Birth and death rates are generally high in the north, medium in the middle and low in the south. The vital indices for all three zones are very much alike. These groups of rates are associated with definite differences in geography which in turn give rise to differences in climate, most marked in the case of winter temperature. There is no difference in the racial constitution of the different groups, sufficient to explain the differences in vital phenomena. These differences are merely pointed out without any claim that there is a causal relationship between geography and human biology.

THE FAMILIES OF FRESHMEN

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A paper was published by the writer in 1928 (The Survival of Intelligence, *Proc. Nat. Acad. Sci.*, 14, 892-894) presenting the results of a study of the relationships between intelligence (of the test variety) and fertility measured in terms of the number of grandchildren of grandparents. This measure proved somewhat difficult for the subjects to understand, and had the further disadvantages that (1) data which the subject must recall and arrange mentally are nevertheless lost to the experimenter, and (2) it is frequently desirable to differentiate between siblings and cousins, which is impossible with such a measure. The present study was therefore planned to follow the same general lines, but with the substitution for the grandchildren-of-grandparent figures of an exact pedigree of the grandparents and their children and grandchildren. The accumulation of the data in this expanded form has also made possible the examination of certain other problems in addition to the original one on differential fertility.

The subjects were the members of the class of 1934 at Clark University. The data were collected at the time of the fall intelligence examination (Thurstone) for entering freshmen, the procedure being to require the men to state the facts in the form of a pedigree chart of the Eugenics Record Office type, instructions concerning which were given and demonstrated at the time; any dubious or inconsistent data were checked by personal conference later. The "born alive" basis was used as the criterion of offspring; this has the advantage of being easily stated and understood, and the disadvantage of incurring a certain amount of omission due to the forgetting of children who died young.

Among selective conditions and possible sources of error are the facts that (1) the intelligence distribution for this group is about a standard deviation higher than the general average for all the colleges using the same instrument; (2) there is a noticeable preponderance of men whose parents and their generation retain emotional, traditional

and sometimes geographical connection with a European home country; (3) about an eighth of the class of 71 were unfamiliar with some part of the required pedigree and unable to obtain it, the degree of unfamiliarity ranging from ignorance of the sex distribution of one fraternity to ignorance of all beyond the immediate social family. As is perhaps to be expected, there is a tendency for the omissions to cluster at the lower end of the intelligence scale. The accuracy of the part for which familiarity was professed was checked as carefully as possible by personal conference and is believed to be satisfactory.

The findings may be grouped under the heads Fertility, Sex Ratio, and Intelligence; not all possible relationships between these have been investigated, but only those which seemed to have assignable meaning. A few correlations on birth rank have also been included, but are not of great importance because of the impossibility of fractionating such a small body of data to correct for size of family.

FERTILITY

The fertility measures available are: number in the fraternity of the propositus; number in the fraternity of the father; number in the fraternity of the mother; number of paternal cousins (the index used includes half-siblings as equivalent to cousins, and half the number of half-cousins); number of maternal cousins (same inclusions); average fertility of those of the father's fraternity who reproduced; average fertility of those of the mother's fraternity who reproduced; and the "survival index" of the 1928 study (number in the fraternity of the propositus + one-half the number of half-siblings and cousins + one-fourth the number of half-cousins). For convenience we may use the symbol *f* as a prefix indicating a fertility measure; *p* and *m* as suffixes indicating paternal and maternal respectively; *S* (sibling) indicating the fraternity of the propositus (including himself); *U* (uncle) indicating the fraternity of a parent (including the parent); *C* indicating the group of cousins (with inclusions noted); *A* for the average fertility described; and *si* for the survival index described. The above then become

$$fS$$

$$fUp \qquad fUm$$

$$fCp \qquad fCm$$

$$fAp \qquad fAm$$

$$si$$

The distributions, with their constants, for these measures are as follows:

	1	2	3	4	5	6	7	8	9	10	11	12	Total
fS	11	19	15	9	6	3	4	3				1	71

$M = 3.4$.

	1	2	3	4	5	6	7	8	9	10..22	Total
fUp°	3	10	12	13	9	11	4		4	2	1	69
fUm	1	6	8	18	10	8	8	2	5	1		67

° including 4 cases of half-siblings.
$M_p = 4.76$ (4.50 without 1 extreme case of half-siblings);
$M_m = 4.98$; $d/\sigma_d = 0.56$ (or 1.32).

	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
fCp	8	2	4	9	10	5	8	2	5	1	1	3	1	2	1	
fCm	6		6	8	13	6	6	5	3	3		4	1		2	2

16..18..20..22	23..25	26..30	Total
2	1	1	67
1 1	1 1	1	70

$M_p = 6.19$; $M_m = 6.76$; $d/\sigma_d = 0.57$.

	1.0*	1.5	2.0	2.5	3.0	3.5	4.0	4.5	5.0	5.5	6.0	6.5
fAp	1	6	13	8	18	6	6	2	3	1	3	
fAm		8	15	12	12	6	6	4	3	1	2	

7.0	7.5	8.0	8.5	Total
1	1	1	1	71
2				71

* Index is lower class limit for all continuous variables.
$M_p = 3.54$; $M_m = 3.31$; $d/\sigma_d = 0.30$.

	3	4	5	6	7	8	9	10	11	12	13	14	15	16
si	1	7	7	8	6	7	4	6	5	6	1	1	1	4

17..20..24..27	Total
1..2..1..1	69

$M = 10.6$; $Mdn = 8.9$; 22% below 6.0.

The last measure, *si*, is presented only for comparison with the 1928 results, its place usually being taken in the present study by *fCp* and *fCm*. The means of the 1928 groups ranged from 10 to not quite 15, their medians from about 7.5 to about 13; the average percentage falling below 6.0 (5.3 being the maintenance threshold corrected for mortality before age 27) was then 26.

Coefficients of correlation between corresponding paternal and maternal measures may be called marital coefficients; the three possible marital coefficients of fertility are

$r_{fU} = .34 \pm .07$ $\quad r_{fC} = .13 \pm .08$ $\quad r_{fA} = .61 \pm .05$°

° omitting fraternity of propositus, $.23 \pm .08$.

Twelve of what may be called "heredity" coefficients are possible: *UC, UA, CA*—paternal and maternal; plus *SU, SC, SA*—paternal and maternal. Of these, *UC* is of no value, since the connection between number of uncles and number of cousins is obvious, and there is no method—better than the use of *A*—available by which the data may be corrected for size of family; and there is a scarcely less obvious and uncorrectable relation between *C* and *A*. The remaining coefficients are:

$r_{fUAp} = -.20 \pm .08$ $\quad r_{fUAm} = -.01 \pm .08$
$r_{fSUp} = -.04 \pm .08$ $\quad r_{fSUm} = .03 \pm .08$
$r_{fSCp} = .35 \pm .07$ $\quad r_{fSCm} = .07 \pm .08$
$r_{fSAp} = .69 \pm .04$° $\quad r_{fSAm} = .63 \pm .05$°

° omitting fraternity of propositus, $.32 \pm .08$ and $.17 \pm .08$ respectively. The correlation between the number of *Up* who reproduced and their average fertility is $.14 \pm .08$; the same for *Um*, $-.12 \pm .08$.

Discussion of the relationships of fertility with sex ratio and intelligence will be reserved for the sections on those variables. Considering the data on fertility alone, we find that (1) the 1928 conclusion that the stocks which produce college men are in no danger of extinction is confirmed; (2) there is about as much assortative mating in fertility as in stature; (3) the number of individuals in the fraternity of the propositus is positively related to the number of cousins and to the fertility of those of the parents' siblings who reproduced, but has no relation to the number of the parents' siblings; further, there is a tendency toward a negative relationship between the number born in the parents' fraternities and the fertility of those who reproduced. This

is obscure, but seems to suggest a relation between mortality and fertility the nature and direction of which are uncertain.

SEX RATIO

The available sex-ratio measures are: proportion of males in the fraternity of the propositus; proportion of males in the fraternity of the father; proportion of males in the fraternity of the mother; proportion of males among the paternal cousins; proportion of males among the maternal cousins. Adding to the previous list of symbols the prefix *s* to denote a sex-ratio measure, we may represent these as follows:

sS

sUp *sUm*
sCp *sCm*

The distributions and their constants are:

	.30	.35	.40	.45	.50	.55	.60	.65	.70	.75	.80	.85
sS	2		2		20	3	4	10		4	1	

.90	.95	1.00	*Total*
		25°	71

° includes 9 only children. Of the 250 children considered, 166 are males, a ratio of .665; this corresponds to a rate of 198 males to 100 females, the normal rate at birth varying from 104 to 106.

	.00	.05	.10	.15	.20	.25	.30	.35	.40	.45	.50	.55
sUp						2	3		3		12	4
sUm	4*		2	2		7	9		12		18	1

.60	.65	.70	.75	.80	.85	.90	.95	1.00	*Total*
4	8	2	7	7				14°	66
2	8	2	1	2	1				71

° includes 3 only children; * includes 1 only child.
$M_p = .696$; $M_m = .452$; $d/\sigma_d = 6.95$. Of 328 *Up*, 215 are males (rate 190); of 357 *Um*, 155 are males (rate 77).

	.25	.30	.35	.40	.45	.50	.55	.60	.65	.70	.75	.80
sCp		5	4	5	3	12	5	13	5	4		5
sCm	2	4	5	8	2	9	6	10	5	2	5	3

.85	.90	.95	1.00	Total
2			6	69
1	1		3	66

$M_p = .613$; $M_m = .584$; $d/\sigma_d = 0.25$. Of 394 *Cp*, 204 are males (rate 106); of 460 *Cm*, 230 are males (rate 100).

The two marital coefficients are:

$$r_{sU} = -.03 \pm .08^{\circ} \qquad r_{sC} = .16 \pm .08$$

° omitting 2 cases based on parent only, $-.01 \pm .08$.

All six of the "heredity" coefficients should be meaningful:

$r_{sUCp} = .00 \pm .08$ $\qquad$ $r_{sUCm} = .11 \pm .08$

$r_{sSUp} = -.09 \pm .08$ $\qquad$ $r_{sSUm} = .18 \pm .08$

$r_{sSCp} = .52 \pm .06$ $\qquad$ $r_{sSCm} = .68 \pm .04$

Of the 35 possible correlations between sex ratio and fertility, only those (5) have been chosen for study which concern the relation between these variables *in the same family*—the others yielding only information that would be more directly gained from material on inheritance. These are as follows:

$$r_{sfs} = -.37 \pm .07$$

$r_{sfUp} = -.24 \pm .08$ $\qquad$ $r_{sfUm} = .07 \pm .08$

$r_{sfCp} = -.34 \pm .07$ $\qquad$ $r_{sfCm} = -.12 \pm .08$

The relationship of sex ratio to intelligence will be considered under the latter variable. Considering the remaining data, we find that (1) there is a tendency, too strong to be accidental, for the males considered to be members of predominantly male families and the females to be members of predominantly female families; (2) there appears to be some tendency to inheritance of the sex ratio, particularly on the maternal side; (3) there is an inverse relation between size of family and proportion of males.

INTELLIGENCE

The Thurstone score of the propositus (I) is the only available measure of intelligence. Its distribution is:

	50..90	100	110	120	130	140
I	1 3	3	2	2	6	1

150	160	170	180	190	200	210
3	6	3	4	6	10	5

220	230	240	250	260	270	Total
2	4	4	2	2	2	71

$$M = 184.$$

Thirteen correlations involving I are possible:

$$r_{I/S} = .09 \pm .08^{\circ}$$

$$r_{I/Up} = -.15 \pm .08 \qquad r_{I/Um} = -.05 \pm .08$$

$$r_{I/Op} = -.02 \pm .08 \qquad r_{I/Om} = .02 \pm .08$$

$$r_{I/Ap} = -.16 \pm .08 \qquad r_{I/Am} = -.14 \pm .08$$

$$r_{Is} = .01 \pm .08$$

$$r_{IsS} = .13 \pm .09$$

$$r_{IsUp} = .22 \pm .08 \qquad r_{IsUm} = -.02 \pm .08$$

$$r_{IsOp} = .13 \pm .08 \qquad r_{IsOm} = .22 \pm .08$$

° This critical coefficient is derived from a scatter diagram showing a tendency, impossible to establish with certainty on account of the small quantity of data, for the regression line of intelligence on size of family to be V-shaped—i. e., for the families of increasing size to produce freshmen of decreasing intelligence, *up to five*, at which point the tendency is reversed.

The following conclusions may be drawn from the intelligence data: (1) although partially obscured in the immediate family of the propositus, fragments of a tendency to the familiar negative relation between intelligence and fertility are still discernible in correlations with more remote fertility measures; (2) the negative relation of —.32 obtained in 1928 between survival index and intelligence has disappeared; (3) intelligence in the propositus appears to be related positively to proportion of males in the stock, the one exception (mother's fraternity) being due to the tendency of mothers to be members of predominantly female families.

MINOR FINDINGS

Twinning.—Of 248 births to mothers of propositi, 2 were of twins (1:124); one pair was heterosexual, the other female. Of 684 births in the parents' fraternities, only one was reported as a twin birth; it was heterosexual, and occurred on the paternal side. Of 852 births to siblings of parents, 4 were reported as twin births (1:213); two of these were heterosexual and two female, three were on the maternal side, and two cases were cousins of the same propositus, the only case noted of heredity in twinning. Nothing certain can be deduced from this (the unreliability of the data for the more remote relatives must be kept in mind), as the usual ratio (1:87) is derived from unselected births, not groups of sibling births; it will be observed, however, that the usual ratio falls between the ratio of twin births to mothers (1:71) and the ratio of twin births to all births (1:124)—using only the fraternity of the propositus, where the data are reliable. Thus it seems likely that there are no twinning characteristics peculiar to this group. The absence of male twins is of some interest.

Monogamy.—Of the 284 grandparents, two were reported as having married twice and two three times; this corresponds to a monogamy index (number of matings divided by half the population) for this group of 1.02 as compared with a corresponding figure of 1.11 for the 1928 group. Seven of the (71) fathers and 4 of the mothers were reported as having married twice, corresponding to an index of 1.07. It is possible that this may indicate a secular trend.

Birth rank.—The distribution of birth ranks of the propositi is J-shaped:

1	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*	*Total*
28	21	9	5	1	3	1	1		1	70

The regression lines are, however, approximately straight. The correlation with intelligence is .09 ± .08. The distribution of fathers' birth ranks is:

1	*2*	*3*	*4*	*5*	*6*	*7*	*8*	..	*15*	*Total*
13	17	13	9	5	4	5	2		1	69

The correlation with intelligence of propositus is —.21 ± .08. The limitations of these results have been pointed out above.

The correlation between intelligence of the propositus and the number of his brothers (not siblings) is .15 ± .08; if real, this coefficient is

probably a function of the correlation between intelligence and maleness of family already noted. The average intelligence of propositi whose next older sibling is a brother is 176; of those whose next older sibling is a sister, 189; and of those who have no older sibling, 192. The two higher values compared with each other yield a d/σ_d of 0.5; compared with the lower value, of 2.0 and 2.3 respectively. This is reminiscent of a finding by Thurstone and Jenkins of the Chicago Institute for Juvenile Research, viz., that the next older sibling of a problem child is significantly oftener a brother than a sister.

CONCLUSIONS

By analysis of pedigree charts of 71 freshmen for whom intelligence scores were also available it was found that (1) the great majority of stocks producing college men are much more than maintaining themselves; (2) the degree of assortative mating in fertility is of the order represented by a coefficient of .2; (3) there is probably a tendency to inheritance of fertility, obscured, however, by mortality factors; (4) the males considered are members of predominantly male families and the females of predominantly female families; (5) there is probably a tendency to inheritance of the sex ratio; (6) there is an inverse relation between size of family and proportion of males; (7) the correlation between fertility and intelligence is in the neighborhood of zero, with possibly a slight tendency in the negative direction; (8) there is a positive relation between intelligence and proportion of males in the stock, except where obscured by the tendency of mothers to come from predominantly female families. None of these conclusions except (4) can be considered definitely established, due to the small numbers involved; their significance, however, is greater than is indicated by the individual probable errors, since they are based for the most part on several mutually corroborative coefficients derived from populations having only a small degree of dependence. In evaluating the results it should be kept in mind that in this field small size of a coefficient has in itself relatively little bearing on its importance; for example, a coefficient of .1 between intelligence and fertility, *if definitely established*, indicates a direction of evolution as clearly favorable as would one of .9; the only difference indicated is one of speed.

The method indicated is believed to be sufficiently simple and revealing to warrant its application to larger populations.

VITAL STATISTICS OF NEW IRELAND (Bismarck Archipelago) AS REVEALED IN GENEALOGIES

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INTRODUCTION

The purpose of the following study was to obtain birth and death rates which would show whether the native population is declining and, if it is, whether the decline is due to a low birth rate, a high mortality rate, or both. Sex ratios at birth and at the time of reproduction were also obtained.

The statistics were collected in a Melanesian community in New Ireland, (one of the islands in the Bismarck Archipelago and part of the Mandated Territory of New Guinea) where the writer lived for ten months. One linguistic unit, consisting of five villages on the east coast, about eighty miles from the northern end of the island, provided the material for the ethnological research. The villages were Ambwa, Lesu,[2] Langania, Libba and Tandis, and their total population is approximately 1,200. Residence was established in the village of Lesu, with a population of 222, and the bulk of the statistics were collected there.

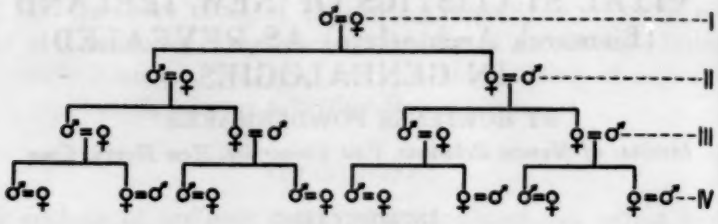
METHOD

Four hundred and fifty-five women and their offspring are the basis of the study. The statistics were collected by the genealogical method and figures for three generations were thus obtained. The results show the trend for approximately the last hundred years. The genealogical method serves as a means for the comparison of age groups. Among a

[1] The ethnological field work was done in 1929-1930, under the auspices of the Australian National Research Council and the author is now a Fellow of the National Research Council (U. S.), under the sponsorship of Dr. Clark Wissler.

[2] The spelling on government publications is Lossu. The spelling used in this text more closely approximates the native pronunciation of the word.

stone-age people, where the unit of a year is unknown, and where there is no record of ages, written or otherwise, this is a way of getting around the question of age. One can, through the use of genealogies, classify everyone according to generation. Thus, given a number of genealogies, such as



all those on the line with *I* are in one generation, those on the line with *II* in another, and those on the line with *III* in still another, and so on.

The generations have been indicated as follows: Those persons in generation *I* are a past generation in which the women are dead. The generation described as *II* are the children of *I*, and the women are old, past the childbearing period. Number *III* are the children of *II* and are women who have reached their menopause. The group known as number *IV* are young women whose marriage is of more than one year's duration and who are in the childbearing period, frequently in the beginning of it. This group can be used only in a limited manner. The sex, name, clan, order of birth (first, second, or third born, etc.), approximate time of death and various other ethnological facts were recorded for each person in the genealogies.

Because of the lack of a calendar and complete ignorance of their chronological age, intervals of time have to be calculated from the physiological crises occurring in the life history of an individual. The lactation period lasts from two to three years. The period of childhood indicates the time between the end of the lactation period and the beginning of puberty, approximately between the ages of two and a half or three and thirteen.[8] Youth covers the period from the end of childhood

[8] The average age for the beginning of menstruation in the tropics is said to be 12.9 years. See Carr-Saunders, A. M.—*The Population Problem*, 1922, Oxford, p. 91.

For the boy there is no such clearly marked physiological end of childhood. Circumcision occurs, roughly, any time between the ages of about eight and twelve, or thirteen. It is a communal rite, held when the necessary food and wealth have been accumulated, and all the boys of the village within these age boundaries are circumcised at one time.

to about sixteen, and by young manhood and womanhood is meant the time between the end of youth and the early twenties. These, of course, are only generalizations.

Since the main object is to determine infant and childhood mortality rates, and survival rates at the time of reproduction, death rates are calculated only for the period up to marriage. The point is to find out how many people survive until the time when they can reproduce themselves. It must therefore be remembered that the total number of deaths is always the total number occurring before marriage. Moreover, in the genealogical method, where in one classification all the principals are dead, this is the only feasible procedure.

It is obvious that there will be a certain amount of error in any vital statistics collected among a people where there are no records of birth and death, but the importance of real and classificatory relatives, the rather formalized pattern of behavior between them, and the elaborate pregnancy, birth, and death rites, and interclan marriages, enables a Melanesian native to give a fairly accurate genealogy. It may be also that the very absence of written records throws a heavier burden upon the individual's memory, which he does not shirk. But it is obvious that no matter how good the memory of Melanesian informants, errors in these data must exist. They are, however, in the nature of the material and would probably exist in any study made on a similar primitive people. As far as possible, these errors are indicated in the description of the tables, which, it should be understood, denote general trends rather than exact statements. The genealogical method, while taking much more time than the census method, enables one to separate the subjects into age groups and presents a more comprehensive prospective over a longer period of time. But because of the great amount of detailed work and time involved in the use of this method, it is only practical for a small unit of people.

The nearest comparable figures are those of the recent government census taken in 1929 for a part of the east coast of New Ireland (from Kavieng to the village of Karu, approximately 147 miles beginning at the northern end of the island) and which includes over a larger area the people designated in this study as generations II, III, IV, but excludes those in generation I (the dead).[4] The results of the government

[4] Chinnery, E. W. P.—*Anthropological Report*, No. 6, Territory of New Guinea. In print.

census are compared whenever possible to the results of this genealogical study of a smaller unit of the same people, for the purpose of checking the accuracy of the latter study.

ETHNOLOGICAL FACTS

Before presenting the tables it is pertinent to give a few ethnological facts related to the statistics. This group of Melanesians are an agricultural, matrilineal and matrilocal people, with exogamous moieties subdivided into clans. There is no scarcity of land, which is communally owned, and getting sufficient food is not difficult, although it requires a certain amount of industry. The diet is limited, taro being the staple food. This is supplemented by fish, pigs, yams, bananas, pawpaws, coconuts, etc.

Sexual customs have an important bearing on the statistics. A girl is usually married directly after her first menstruation. A man's preferred mate is the mother's brother's daughter's daughter, or the father's sister's daughter's daughter, and he is thus of a generation above his wife. While the preferred marriage quite frequently does not take place, the husband is almost always older than his wife, usually a difference of about five to ten years. The girl has had no sexual intercourse, although she has indulged in sexual play, but the man, being some years past puberty, has had sexual experience previous to the time of his marriage. There are no unmarried women. There may be a couple of young widows in the community, but it is just a question of time before they remarry. Both husband and wife have extra-marital intercourse and there is no social stigma in having lovers or mistresses. Rather, it is the correct thing to do. The husband of the mother is always the sociological father of her children. Until very recently it was quite usual for a man to have two wives and this had been the case with most of the married men of my community. It was relatively rare for a woman to have two husbands, although it did and still does happen occasionally. Missions have taught a monogamous system of marriage, with partial success. Polygamy still exists, but not to the same degree or extent as it did a generation ago. White contact has scarcely affected extra-marital intercourse. Should the village be close to a mission center (mine was not) love affairs would simply be carried on more

surreptitously. Divorce is moderately common and individuals may have a succession of mates.

During the period of pregnancy a women may have no sexual intercourse with her husband or anyone else. The man may, however, have sexual intercourse with a woman other than his wife. After the birth of the infant neither the mother nor her husband may have intercourse with each other, or with anyone else, during the period of lactation. For the women there is thus an abstention from sexual intercourse for a minimum of three years and for perhaps as much as four. This taboo, if kept, would cause a long interval of time between births. It is difficult to find out exactly how strictly it is kept. Like all taboos in primitive societies it is sometimes broken. But one cannot collect statistics on the subject because one only hears of the cases when the culprits are found out. After living in the society for almost a year, the writer is of the opinion that it is kept moderately strictly. There is a grave social stigma for those who break it and are found out, and their infant is supposed to become ill. One such case happened during the author's visit and was the cause of much gossip. It was known that the parents of a certain sickly infant had broken the taboo and the natives all pointed to their unhealthy infant as the result. It is more difficult to break this taboo and not be found out than it is for a member of our society to transgress our custom of monogamy and not be caught. In the primitive society under discussion there are several conditions which make secrecy difficult. First, the village is small, numbering only a couple of hundred, and everyone knows everyone else well. Secondly, practically all of the social life is carried on outdoors, and extra-marital intercourse generally takes place in the bush, which limits somewhat the privacy. Thirdly, these people, like all others, love to gossip and indulge in it to a great extent. It is therefore not easy to conceal a violation of this taboo. The social disgrace of being detected, and the belief that it will harm the child, are strong deterrents in a society motivated largely by social prestige.

There is no infanticide and, as far as I know, no physical means of abortion. There is, however, a leaf, or rather several leaves, chewed by the women and believed to cause sterility. There is another leaf which if chewed within two months after conception will make the embryo disappear, according to native belief. Specimens of both kinds

of leaves were obtained, but the writer has not yet had the opportunity of having them identified. Sterile women seriously attribute their sterility to the use of these leaves, and natives swear by their efficacy. But so do they also swear by their ability to make it rain by magic.[5]

Women usually work in their gardens right up to the time of giving birth to the child. Occasionally they may slacken their labor a bit a month or so before the time of birth, but this is not the rule. They resume their work usually about two weeks after birth. The long period of lactation has already been mentioned. In addition to the mother's milk, the infant is fed on baked taro within a day or two after birth. The mother chews it first and then gives it to the infant. There are other practices and customs which indirectly have a bearing on the vital statistics, but in this paper only the obvious ones can be indicated.

Household Census

Before presenting the statistics, a household census for one village (Lesu) is given. The household corresponds roughly to the individual family and its usual occupants are husband and wife, female unmarried children and young male children. Should a man have two wives, each one will usually have her own home, but sometimes they share the same house, particularly if there is much discrepancy in their ages. Should a woman have two husbands, one of them will usually count the men's house as his home. The unmarried men and boys of from approximately ten years sleep in the men's house. But this does not prevent the young boys from eating with their family and being a part of the household as far as sharing its duties and pleasures. Married men, for various reasons, occasionally sleep in the men's house. The girls sleep at home until they are married, and there is no women's house corresponding to the men's house. An older relative (widow or widower), too feeble to live alone, may also be an occupant of the household.

The village of Lesu contained 66 households. There were 62 adult males and 63 adult females (all married), and 65 male children and 42 female children. Nine of the adult males and two of the females were

[5] Dr. Hrdlička investigated certain objects which Indians believed would cause artificial sterility. He found them ineffectual. Hrdlička, A., Physiological and Medical Observations among the Indians of Southwestern United States and Northern Mexico. Bureau of American Ethnology, Bulletin 34, p. 165.

working on coconut plantations. Among the adults there were six widowers and seven widows (mostly old). There was thus a total population of 222 (eleven of whom were absent) living in 66 households.

RESULTS OF THE STUDY

Birth Data

Table 1, which follows, presents the average number of offspring for all women and for each fruitful woman for three generations. As noted earlier, the females studied were divided into four groups according to their generation, those called *I* being dead, *II* old, *III* middle-aged, and *IV* young. The last group is omitted from the following table because the women are too young to have completed their childbearing period. Those unions in which the marriage was of short duration because of divorce or the death of the husband, (and no record was found of the woman's subsequent re-marriage), and those in which the woman died before the end of her childbearing period are omitted. The number of the former are 17 and the latter 23.

TABLE 1

Birth Rates

GENERATION	TOTAL NUMBER OF WOMEN	NUMBER OF OFFSPRING	AVERAGE NUMBER OF OFFSPRING PER WOMAN	NUMBER OF FRUITFUL WOMEN	AVERAGE NUMBER OF OFFSPRING PER FRUITFUL WOMAN
I	150	431	2.8 ± .119	142	3.
II	90	194	2.1 ± .159	74	2.6
III	55	150	2.7 ± .26	44	3.4
Totals	295	775	2.6	260	2.9

From the above table it appears that the people studied have had a practically stable birth rate for three generations: an average for the three groups of 2.6 per woman and 2.9 per fruitful woman. This is slightly higher than the rate given in the recent government census, the average issue per union being given there as 2.0 and per fruitful union as 2.7.[6] If the issue rate of generations *II* and *III* (which cor-

[6] Chinnery, E. W. P.—Anthropological Report, No. 6, Territory of New Guinea. In print.

responds more closely to the people on whom the government census was taken) is averaged, the difference between that and the rate given in the census is even less.[1] Since there is such close agreement between the figures computed by two different methods, it would seem that the issue rate, at least for the women of generations *II* and *III*, is fairly accurate. But there are no comparable figures for the issue rate of the women in generation *I*, and it is here that there is the largest possibility of error, because the principals are dead and could not be used as informants.

If the women of all three generations are classified according to their number of offspring, as in the following table (No. 2), it will be seen that the birth rate for the larger number of women is slightly higher than the average rate as given in Table 1.

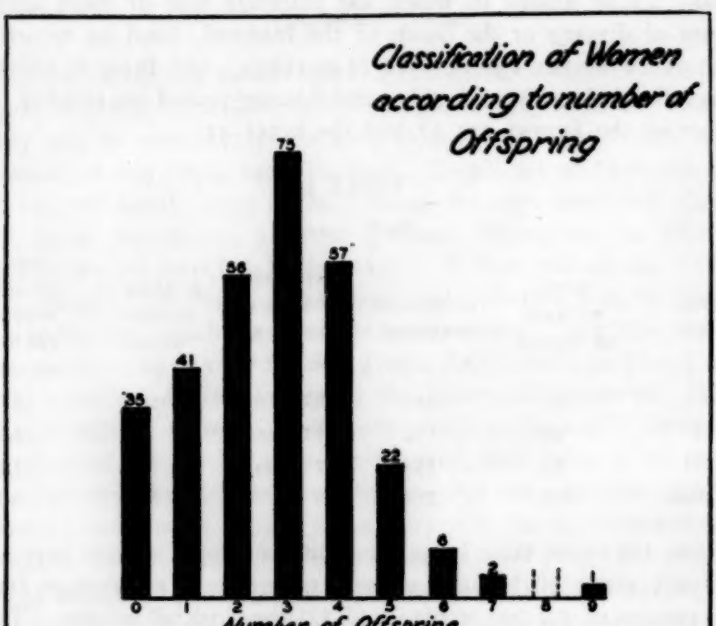


CHART I

[1] The difference is 0.4 per woman and 0.3 per fruitful woman.

TABLE 2

Distribution of Women by Number of Offspring

											TOTALS
Number of women	35	41	56	75	57	22	6	2	0	1	295
Per cent of women	11.8	13.9	19.	25.4	19.4	7.4	2.	0.7		0.3	99.9
Number of offspring	0	1	2	3	4	5	6	7	8	9	775

Of the 295 women, the largest group have three children and the next largest groups have four and two offspring respectively. Very few of the women have more than five offspring.

While the average issue rate for the women of this study seems very low, it does not vary very much from the rate of fecundity for the native-born women in the United States in recent times. Statistics on this subject are available only for certain sections of the country and for certain classes of people. In 1905, in Rhode Island, the average number of children born to native-born married women was 2.06 and to foreign-born married women 3.35.[8] From the census of 1900 a study of fecundity was made for the region including the state of Rhode Island, the cities of Cleveland and Minneapolis, 48 mainly rural counties of Ohio, and 21 mainly rural counties of Minnesota. The women of native white parentage had 2.7 children, while those of foreign parentage had 4.4 children.[9] The number of children per married couple of Yale graduates in the period 1881-90 was 2.04.[10] (The fertility of foreign-born stock in the United States is much higher and ranges from 6.2 for the Poles, to 3.4 for the English.[11]) It would seem that the fecundity of the Melanesians in New Ireland, while low, is about equal to that of the native-born whites of this country. Now, according to Carr-Saunders, fecundity has increased with civilization. He presents no statistical evidence for this theory, but he gives much suggestive evidence from primitive people all over the world.[12] The low rate of fecundity among the native-born white women of the United States is probably due to the use of contraceptives and cultural factors, such as

[8] Holmes, S. J., The Trend of the Race, *N. Y.*, 1921, p. 125.
[9] *Ibid.*, p. 127.
[10] *Ibid.*, p. 136.
[11] *Ibid.*, p. 128.
[12] Carr-Saunders, A. M., The Population Problem, *Oxford*, 1922, pp. 92-105.

economic conditions, time of marriage, etc., and does not therefore invalidate Carr-Saunders' theory.

Although it is not absolutely certain, it appears that the people of this study have maintained a stable birth rate over three generations, yet at the same time there seems to be an increase in the percentage of sterile women. If the number of sterile women are grouped according to their generation, the percentage of sterility over the three generations can be measured. Table 3 presents this.

TABLE 3

Sterility Rates

GENERATION	NUMBER OF STERILE WOMEN	PER CENT OF WOMEN WHO ARE STERILE
I	8	5.3
II	16	16.6
III	11	20..
Totals	35	11.8

It can be seen that the percentage of sterile women jumps from 5.3 per cent to 20 per cent in three generations.[18] There is not the same possibility for error in this rate as there is in the issue rate for the women of generation *I*, for if the informants forgot to give children of these dead women, it would have made the sterility rate higher than it should be and the corresponding increase in sterility to the present time would be still greater. The same fault of memory would have made the fecundity of these women lower than it should be, and there is thus the possibility that the birth rate may have declined instead of being stable. The error could only be one way and we know therefore that the birth rate has not increased.

It is the opinion of the writer that the low rate of fecundity and the increase of sterility among these Melanesian women may be due to the introduction of syphilis and gonorrhoea, usually the accompaniment

[18] cf. Pitt-Rivers, G. H. L. F., The Clash of Culture, *London*, 1927, Table IV, Appendix II, taken from Indian Population of the U. S. and Alaska, 1910, p. 157. The sterility for North American Indian and mixed-blood women between the ages of 15 and 44 years, and married one year or more, varies from 4.3 to 16.6, the highest percentage falling among the marriages of full-bloods.

of white civilization. Gonorrhoea is considered the cause of a large percentage of sterility, and when not causing complete sterility frequently limits the family to one or two offspring. There is a difference of opinion on the effect of syphilis on the pregnant woman and her offspring, but there appears to be evidence that syphilis tends to reduce the number of pregnancies. In a study made on syphilitic and non-syphilitic families, the number of pregnancies in syphilitic families was 2.58 compared with 3.8, 4.4 and 5.5 in non-syphilitic families.[14] The evidence for the presence of these diseases among this people, and their further connection with the vital statistics will be discussed in the latter part of this paper. Here it is only necessary to indicate a possible relationship between them and the birth and sterility rates.

Death Data

Having learned that the birth rate has not increased, i.e., that it is either stable or declining, it is of interest to note the death rate for the same people. The following table presents the number and percentage of those born in each of the three generations who died before marriage. The time of death is indicated by the physiological periods described in the introduction.

TABLE 4

Death Rates Based on Number of Births

GENERATION	BORN DEAD		DIED DURING LACTATION PERIOD		DIED DURING CHILDHOOD		DIED DURING YOUTH		DIED AS YOUNG MAN OR WOMAN		TIME OF DEATH UNCERTAIN		TOTAL DYING BEFORE MARRIAGE	
	No.	Per cent	No.	Per cent	No.	Per cent	No.	Per cent	No.	Per cent	No.	Per cent	No.	Per cent
I	1	.2	13	3.	25	5.7	11	2.5	17	3.9	19	4.3	86	19.5
II	1	.5	11	5.4	12	5.9	3	1.5	1	.5	2	.1	30	14.9
III	3	1.8	24	14.9	6	3.6	2	1.2	4	2.4	1	.6	40	24.3
IV	1	.5	29	16.3	..	...	..	...	..	...	..	...	..	...
Totals	6	.6	77	7.9	43	5.4	16	2.	22	2.7	22	2.7	156	19.5

There has been an increase in the mortality over the three generations. Among the offspring of generation *I*, 19.5 per cent of those born died before reaching the age of marriage, while 24.3 per cent of the children of group number *III* have already died before marriage. This

[14] Solomon, H. C. & M. H.—Syphilis of the Innocent, *Washington*, 1922, p. 128.

percentage will probably be still higher in a few years, as all the children of these women have not yet had time to reach the marriageable age. There is a decrease of 4.6 in the per cent of all deaths occurring before marriage for the offspring of group number *II* as compared to the offspring of number *I*. Of this decrease 4.4 per cent occurs in the two periods of youth and young manhood, or in the interval between the end of childhood and time of marriage. If Table 7, giving the sex ratios for these periods, is consulted it will be seen that there is a much smaller percentage of masculinity during this interval (i. e. from the end of childhood to the time of marriage) for the offspring of number *I* than for the offspring of either of the other two generations. This means that a larger per cent of males among the offspring of number *I* died during this period than among the offspring of number *II*. It is probable that a large number of these male deaths among the children of number *I* were due to warfare, which was abolished by the mandated government about the time the children of number *II* were growing up. One can therefore assume that the decrease in mortality rate for the offspring of number *II* as compared to the preceding generation is due to the abolishment of warfare. On the other hand the same absence of warfare is operative as an influence on the mortality rate for the children of number *III*, and yet there is an increase of almost 10 per cent in the death rate before marriage for the children of this group over the preceding generation.

Before discussing in more detail the death data, it is necessary to give the following table, which shows the percentage of total deaths before marriage, occurring during the different physiological periods. This brings out more clearly than the preceding table the distribution of deaths from birth to time of marriage.

TABLE 5

Percentage Distribution of Total Deaths Before Marriage

GENERATION	BORN DEAD	DEATHS DURING LACTATION	DEATHS DURING CHILDHOOD	DEATHS DURING YOUTH	DEATHS DURING YOUNG MANHOOD AND WOMANHOOD	TIME OF DEATH UNCERTAIN
I	1.1	15.1	29.	12.8	19.7	22.
II	3.3	36.6	40.	10.	3.3	6.6
III	7.5	60.	15.5	0.5	10.0	2.5
Totals from generations I and II	1.7	20.6	31.9	12.	15.5	18.1

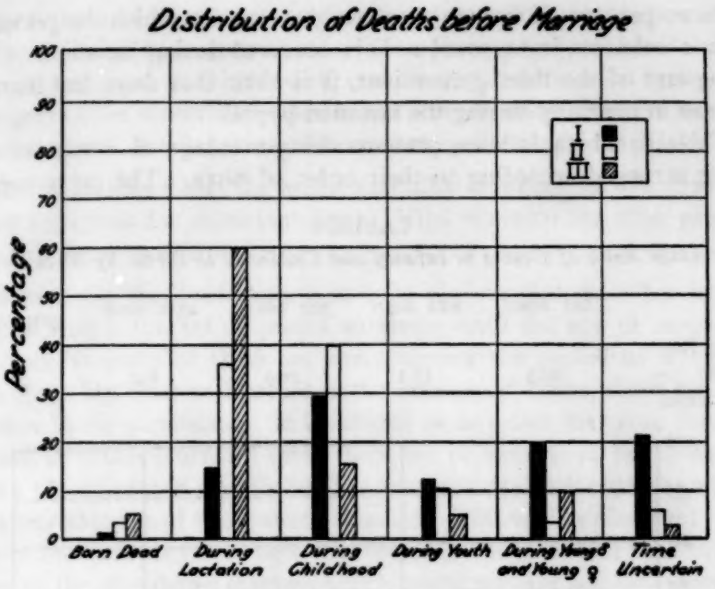


CHART II

There is a marked increase in the per cent of total deaths occurring during lactation. It must be noted, however, that the time of 22 per cent of the deaths occurring before marriage among the children of generation number *I* was not known to the informants. Assuming that the whole 22 per cent occurred during the period of lactation, which is possible, there is still an increase of 23 per cent of the total deaths which occurred during lactation for the offspring of group *III*, as compared with the offspring of group number *I*. For reasons already indicated, it is possible that there may be an error in the mortality rate as well as in the issue rate for generation number *I*. It will be wiser, therefore, to compare the mortality rates during lactation for the offspring of generations *II* and *III*, which are considered more accurate because the principals are all living and because the statistics concerning them compare so closely to the recent government census.[15] There is an increase of 24 per cent in the deaths occurring before marriage which take place during lactation for the offspring of group number *III* as compared to the offspring of group number *II*. This increase be-

[15] Chinnery, E. W. P.—Anthropological Report, No. 6, Mandated Territory of New Guinea, (in press) gives an infant mortality rate of 19 per cent as compared

comes 20 per cent, if in both cases the per cent for which the period of death is unknown is supposed to have occurred during lactation. Comparing any of the three generations, it is clear that there has been an increase in mortality during the lactation period.

Table 6, which follows, presents the percentage of deaths of offspring arranged according to their order of birth. The percentage is

TABLE 6

Percentage Ratio of Deaths in Infancy and Childhood to Births by Birth Order

	1ST BORN	2ND BORN	3RD BORN	4TH BORN	AFTER 4TH BORN
Totals for all four generations	20.9	17.1	11.9	8.2	3.

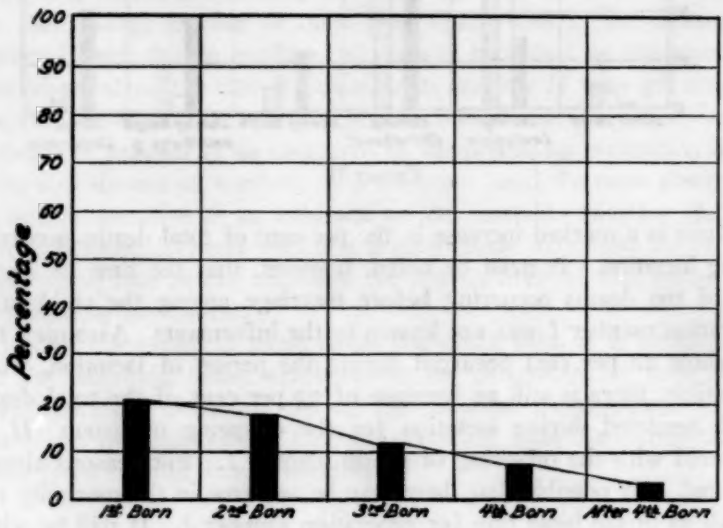


CHART III

PERCENTAGE OF DEATHS ARRANGED ACCORDING TO THEIR ORDER OF BIRTH
The percentage is based on the total number of deaths from birth to end of childhood.

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to 16.4 per cent for the children of generation number III and to 17.5 per cent for the children of generation number IV of this study.

In the United States the mortality rate for the period from birth to the age of three years is 14.9 per cent. Computed from United States Life Tables, Dept. of Commerce, Bureau of the Census (based on the mortality rates for both sexes in the Original Registration States for 1910).

based on the total number of deaths occurring from birth to the end of childhood for all four generations. These percentages are based on incomplete numbers, as this kind of recording was done only during the latter part of the writer's expedition, and therefore for a limited number of genealogies. But they are sufficient to show the general trend.

This table shows that the infant mortality is higher for the first and second born than for those born later. Vital statistics for other peoples show this same tendency.

Considering the death data, it is quite obvious that there has been a decrease in the number of people surviving until the age of reproduction, because more of them are dying during the period of lactation. Since there has been no increase in the number of births, there must be a decline in the population. It is difficult to ascertain the cause for this increase in infant mortality when there are no records of the causes of death. Once again, it is probable that the cause of death might be traced to the introduction of white man's diseases. This will be discussed more fully in the Summary, but here it is important to note that tuberculosis is one of the introduced diseases which might account for the heavy increase in infant mortality. It is generally agreed that if the mother is tuberculous the chance for the infant living is very much lessened.[16] Also, a large percentage of mortality from tuberculosis occurs with young children.[17]

Syphilis, another introduced disease, tends to increase the deaths due to accidents of pregnancy, such as abortions, miscarriages and stillbirths.[18] It must be remembered that premature births, or abortions,

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[16] Woodbury, R. M.—Causal Factors in Infant Mortality, U. S. Dept. of Labor, Children's Bureau, Pub. No. 142, p. 35.

[17] Bushnell, G. E.—A Study in the Epidemiology of Tuberculosis, *New York*, 1920, p. 163.

[18] Solomon, H. C. & M. H.—Syphilis of the Innocent, *Washington*, 1928, p. 128. cf. Jean, P. C.—Syphilis and its Relation to Infant Mortality, *Am. Jour. of Syph.*, Vol. III, No. 1, 1919, p. 122. "In a syphilitic family 30 per cent of the pregnancies terminate in death at or before term, a waste three times greater than is found in non-syphilitic families."

Cf. also Williams, J. W.—The Significance of Syphilis in Prenatal Care and in the Causation of Foetal Death, *Bull. of the J. H. H.*, Vol. XXXI, No. 351, May, 1920, pp. 142-145. In a study made on the causes of 302 foetal deaths, 89.3 per cent of the deaths are attributable to 7 groups of causes, of which syphilis is the most important as it accounts for 34.44 per cent of the total number.

would be given to the writer as ordinary births and deaths. The pregnant woman loses count of the number of months she is pregnant and there was therefore no way of distinguishing between abortions and ordinary deaths occurring at birth. The percentage of those born dead thus includes abortions. It is interesting to observe that there was an increase in the percentage of those born dead over three generations. But on the other hand, this might also be due to a more accurate recording for the present than for the past, and since the numbers are small these percentages would be easily upset by a greater degree of accuracy for the recording for generations *II* and *III*, than for *I*. The presence of syphilis would not only account for an increase in foetal deaths, but it might also be a cause of infant mortality. In one study it was found that "Thirty per cent of all the living births in a syphilitic family die in infancy, as compared to a normal rate of 15 per cent in the same class." [19] Again, if the infant himself has syphilis he has just half the expectation of life of a non-syphilitic infant.[20]

Other theories accounting for the decline of native populations, and a fuller discussion of the subject of introduced diseases will be given in the Summary.

Sex Ratios

The connection of sex ratios with a declining population is also of interest. Pitt-Rivers has drawn attention to the significance of sex ratios by his theory that an increasing masculinity occurs when a people is dying out or declining.[21] He points out that it is more important to know the sex ratios for those surviving at the time of reproduction than the sex ratios at birth. The following table gives both.

Table 7 gives the sex ratios at birth, at the end of childhood, and at the time of marriage. The percentage is based on the total number—both sexes—at each one of these periods. Eight offspring were not counted because their sex was not known to the ethnologist.

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[19] Jean, P. C.—Syphilis and Its Relation to Infant Mortality, *Am. Jour. of Syph.*, Vol. III, 1919, p. 122.

[20] *Ibid.*, p. 120.

[21] Pitt-Rivers, G. H. L. F.—The Clash of Culture, *London*, 1927, Supplement on Sex Ratios, *passim*.

TABLE 7

Sex Ratios

GENERATION	AT BIRTH			AT END OF CHILDHOOD			AT TIME OF MARRIAGE		
	Per cent of ♂	Per cent of ♀	Diff.	Per cent of ♂	Per cent of ♀	Diff.	Per cent of ♂	Per cent of ♀	Diff.
I	53.9	46.1	+ 7.8	54.4	45.5	+ 8.9	51.1	48.8	+ 2.3
II	58.3	40.7	+17.6	57.2	42.7	+14.5	55.7	44.3	+11.4
III	53.4	46.5	+ 6.9	56.5	43.4	+13.1	54.9	45.1	+ 9.8
IV	54.7	45.3	+ 9.4	...	...	.....	...	...	.....
Totals	55.	45.	+10.	55.5	44.4	+11.1	53.	46.9	+ 6.1

+ Indicates excess of males.
— Indicates excess of females.

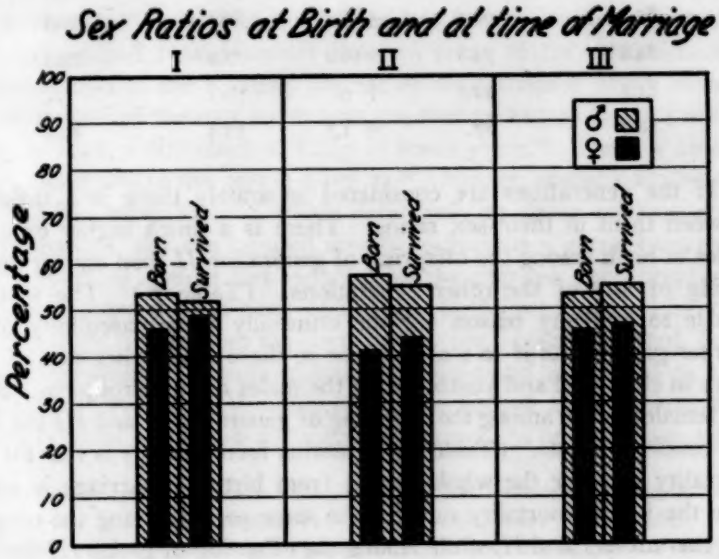

CHART IV

In all four generations there are more males born than females, which is true of most peoples. At the time of marriage there is still an excess of masculinity, but less than there was at birth. It must, however, be remembered that the male is older than the female at the time of marriage and that there is accordingly more opportunity for him to die before marriage.

Table 8 must be presented before continuing the discussion of Sex Ratios. The following table gives the percentages by sex for those surviving until the end of childhood and the time of marriage. The per cent is based on the number of each sex born.

TABLE 8

Ratio of Individuals of Each Sex Surviving

GENERATION	PER CENT OF MALES BORN SURVIVING UNTIL END OF CHILDHOOD	PER CENT OF FEMALES BORN SURVIVING UNTIL END OF CHILDHOOD	DIFF.	PER CENT OF MALES SURVIVING UNTIL MARRIAGE	PER CENT OF FEMALES SURVIVING UNTIL MARRIAGE	DIFF.
I	91.9	90.	+ 1.9	76.	85.	— 9
II	85.3	91.3	— 6	80.1	91.3	—11.2
III	84.8	74.6	+10.2	77.9	73.3	+ 4.6
IV	81.7	72.7	+ 9.	...	...	.....
Totals	88.7	87.	+ 1.7	75.5	83.9	— 8.4

If the generations are considered separately there is a difference between them in their sex ratios. There is a much higher excess of males at birth among the offspring of generation *II* than among the offspring of any of the other generations. (Table 7.) The writer is unable to find any reason for the unusually high masculinity of the former group. As if to make up for it, there is a higher rate of mortality in childhood and youth among the males of this group than among the females, while among the offspring of generations *I* and *III* the opposite condition exists. (Table 8.) Another inconsistency is that the male mortality rate for the whole period from birth to marriage is greater than the female mortality rate for the same period among the offspring of generations *I* and *II*, while among the offspring of group *III* the mortality rate is less for the males during this period. Again no adequate reason can be given. Where the numbers are small, any incidental factors, such as the outbreak of some particular disease affecting one sex more than the other, might easily change the ratios. An error might also lie in the recording, and it may be that an apparently unusual excess of masculinity might be because of the fact that some informants remembered males better than females. On the other hand, to offset this, it must be remembered that this study was made in a matrilineal society,

with inheritance of clan and property in the female line. There are therefore more practical reasons to remember females than males.

However, the sex ratios with their apparent inconsistencies are presented for what they are worth. There is no ambiguity about the fact that there is a higher masculinity at birth and at the time of reproduction for this particular group of a declining people.[22]

SUMMARY

The people on whom this study was made are generally considered to be a part of a group which is dying out. Pitt-Rivers says that, "Nowhere in the Pacific is the phenomenon of the disappearance of the aboriginal races more noticeable than in the islands of the Bismarck Archipelago, where European control last made its influence felt." [23] The same author notes that the decline has been even more marked in New Ireland and New Hanover than on some of the other islands.[24] The population of the Kavieng district of New Ireland, which includes the larger part of the east coast, was counted as 14,749 in 1914 and as 13,289 in 1921, a difference of 1,460 in seven years.[25] There is another report which covers the period 1928-29.[26] Mission stations are responsible for the latter figures, which refer only to those sections under mission control, and can be used merely to indicate a general tendency. For the Kavieng district this report gives the decrease per 1,000 living, as 7.2; i. e., there was 7.2 more deaths than births per thousand in 1928-29. The same report gives the decrease for the whole Mandated Territory of New Guinea (excluding Aitape, Morobe and Salamaua) as 3 per thousand for 1928-29. While none of the figures are adequate, they are sufficient to indicate a declining population. The group on which

[22] Another study on a different primitive people has, however, revealed no excess of masculinity in the total population of a declining people. See Hogbin, H. I., The Problem of Depopulation in Melanesia as Applied to Ontong Java. *Journal of the Polynesian Society*, Vol. 39, No. 1, p. 57.

[23] Pitt-Rivers, G. H. L. F.—The Clash of Culture, *London*, 1927, p. 20.

[24] *Ibid.*, p. 20.

[25] *Ibid.*, Tables 1 and 2, given in Appendix VI, reproduced from Statistics relating to Commerce, Native Tax, Population, etc., in connection with the late German New Guinea Possessions, published by the Government of the Commonwealth of New Guinea.

[26] Anthropological Report, No. 6. Territory of New Guinea. Introduction. (In press.)

the statistics in this paper are based is a small unit in this declining people.

By the use of the genealogical method in a study of 455 women, it was possible to compare one generation or age group with another. It was found that there has been an increase in deaths before marriage during the last three generations, and that this increase has taken place during infancy. Since the birth rate is small and not increasing, it is evident that these people must be declining in population.

To discover why more deaths are occurring in infancy is not easy. The causes of death are not known to the natives and there is no government station near enough for any autopsies to be made. All one can do in addition to presenting the factual material is to point out the non-existence of certain causes and to posit, very tentatively, any possible ones. Such factors as feeding and the care of the infant may be ruled out. The infant receives the same care and the same food today that he did three generations ago. The fact that an infant only a few days old is given baked taro to eat happened also several generations ago. Also, there has been no change in the habits of work, or the manner of living in general, for the pregnant woman and for the mother while she is nursing her infant. At birth, there was in the past and still is today, a dependence on the skill of a few native women. The report of a conference called by the Commissioner for Native Affairs and attended by the Director of Public Health and by the representatives of Mission Stations in the Territory, seems to the writer to be quite erroneous in regard to the causes for an increase in infant mortality. The conference was of the opinion "that the high rate of infant mortality is due to:

(*a*) The too early marriage of many women.
(*b*) Undernourishment and improper feeding of infants.
(*c*) Undernourishment of people generally, due to an ill-balanced diet, and in some cases to food shortage.
(*d*) A lack of cleanliness on the part of those handling and feeding infants.
(*e*) Epidemics, e. g., whooping cough.
(*f*) Infanticide." [27]

It has already been shown that for the people on whom this study is made, the conditions indicated by a, b, c, d are exactly the same now as

[27] Report to the Council of the League of Nations on the Administration of the Territory of New Guinea, from July 1st, 1926 to the 30th of June, 1927, *Canberra*, p. 115.

they were in the past, and that while they may be a cause for a high rate of infant mortality they cannot be considered as a cause for an increase in the rate. Epidemics might reasonably be a factor, and there was an influenza epidemic in 1918 and a famine in 1914, due to drought, in New Ireland. There is no record of how many deaths, or the ages of those dying from either influenza or the famine, so that they can only be considered in a general way. The last cause mentioned by the conference, namely infanticide, does not exist now and did not in the past, as far as one was able to observe, among the people on whom this study is based.

Psychological causes for a decline in native populations have been suggested by W. H. R. Rivers and G. H. L. Pitt-Rivers. The former, in his discussion of the conditions which have affected increasing death rates and decreasing birth rates, mentioned the following: the introduction of diseases, of alcohol and opium, of firearms, of European garments, of modified housing, and finally, modifications and interferences with native customs.[28] Dr. Rivers emphasized the last point particularly and believed that the destruction of native institutions deprived the natives of their interest in life. Continuing his discussion of the increasing death rates, he said, "The special point I wish to make in my contribution to this book is that interest in life is a primary factor in the welfare of a people. The new diseases and poisons, the innovations in clothing, housing and feeding, are only the immediate causes of mortality. It is the loss of interest in life underlying these more obvious causes which give them their potency for evil and allows them to work such ravages upon life and health." [29] When he considered the decline in birth rates he again emphasized the significance of mental factors, and thought that the same loss of interest in life might be of importance in

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[28] Rivers, W. H. R., Essay, "The Psychological Factor," in *Essays on the Depopulation of Melanesia*, edited by the same author, Cambridge, 1922, pp. 89-95. Alcohol, opium and firearms are not used by the natives of this study. The men now wear loin cloths when formerly they were naked, and have acquired a consciousness of their bodies which they lacked in the past. The women wear loin cloths also, instead of the straw aprons formerly worn, and they are supposed to wear blouses. The blouse comes off when they are working, and frequently at other times too. Dr. Rivers' point that the natives keep their bodies clean, but not their acquired clothing, applies to these people. The houses have not been modified by European influence. The other two factors, the introduction of diseases and the modification of native customs, are discussed in the text.

[29] *Ibid.*, p. 96.

accounting for it. He wrote, "We have here only another effect of the loss of interest in life which I have held to be so potent in enhancing mortality. The people say themselves: 'Why should we bring children into the world only to work for the white man?' " [30]

Pitt-Rivers has emphasized still more strongly the influence of psychological factors from another point of view and suggests that the destruction of cultural institutions such as magic, economic structure, etc., results in boredom or loss of the *joie de vivre,* which in turn might operate to exterminate a race.[31] He thinks that even though there be normal sexual intercourse, the woman might not conceive because her emotional life had been disturbed, which he would trace to the break up of the native culture through white contact.[32]

The writer of this paper would not deny the possible influence of these psychological factors when they were operative, but the point is that the psychological factors mentioned by Dr. Rivers and by Pitt-Rivers are not present among the people on whom this study was made and therefore cannot be adduced as a cause for their decline. The fundamental aspects of the native culture have not been broken up, and these people are not bored, nor have they lost their *joie de vivre.* Although there has been a fair amount of white contact, and cannibalism and warfare have been abolished by the mandated government, their kinship organization, economic structure, ritual and sexual life, are still actively functioning according to their traditional custom. The people are busy with their daily work (gardening and fishing) and with preparations for the many ritual feasts and dances. They flirt, marry, and have their *affaires du coeur* in a very happy, casual fashion and do not, as Dr. W. H. R. Rivers suggests, ask themselves why they should bring children into the world. They are, as far as can be observed, quite happy, decidedly not bored, and have a real interest in life.

The psychological factors mentioned by the two authors just quoted may be operative on the generation of children now growing up. Many of these have been to mission schools, where they are given the concept of shame in connection with sexual matters, particularly in regard to extra-marital intercourse, which is a very indigenous part of their culture. White contacts are increasing and it is probably only a matter of time before the native culture will be broken up. What the

[30] *Ibid.,* p. 104.
[31] Pitt-Rivers, G. H. L. F.—*The Clash of Cultures,* London, 1927, pp. 142-148.
[32] *Ibid.,* pp. 146-147.

psychological effect of this will be on the birth and death rates of future generations can be, at the moment, only a matter of conjecture.

It is thus necessary to point out that while these psychological factors may be of significance in accounting for a declining population, they are not present among this particular declining people. The adult women on whom this study was made have not been to mission schools and the effect of mission teaching on them is very superficial. The fundamental aspects of their culture have not been destroyed and they have not lost their interest in life.[33]

There is one factor, mentioned by Dr. Rivers but not stressed, which might tentatively be considered as a possible cause for the decline in population, and that is the introduction of the so-called "white man's diseases." While there are no medical records for the group of people on whom this study was made, there are some fragmentary medical records for the whole Mandated Territory of New Guinea, which includes New Ireland.[34] These are based on treatments in native hospitals at the European centers and the natives are mostly indentured laborers from all over the territory. The records can be used to indicate that certain diseases exist in the Territory, some of which appear more widespread than others. It is of interest to note here those that might have any influence on infant mortality.

The reports all mention tuberculosis as being rather widespread. We are told that "tuberculosis, pneumonia and other respiratory diseases cause approximately 50 per cent of all native deaths in Rabaul," and that these diseases are new among these native races.[35] In 1926-27 tuberculosis accounted for about 32 per cent of the total deaths of natives in the series under review.[36] In 1927-28, 103 cases of tuberculosis were treated in native hospitals, and these cases had a mortality rate of 33 per cent, accounting for 13 per cent of the total mortality of hospital cases.[37] In 1928-29, 57 per cent of all the native deaths occurring in native hospitals were due to tuberculosis, pneumonia and dysentery.[38]

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[33] In the writer's forthcoming book, the life of the society as it is functioning today will be described in detail. The contact of other cultures will not be neglected and an attempt will be made to evaluate the effect of this contact.

[34] Reports to the Council of the League of Nations on Administration of the Territory of New Guinea, *Canberra.*

[35] *Ibid.*, 1924-25, p. 17.

[36] *Ibid.*, 1926-27, p. 133.

[37] *Ibid.*, 1927-28, p. 89.

[38] *Ibid.*, 1928-29, p. 26.

From this evidence it would appear that tuberculosis is fairly widespread. The effect of tuberculosis in increasing infant mortality has already been pointed out.

Housing conditions are of importance in this connection. The house consists of one room, with walls of bamboo, a thatched roof, and the beaten ground as a floor. There are no windows and just one door, which is usually kept shut when no one is in the house. It is quite impossible for any sun to get inside the house. While the native spends most of his time outdoors, he sleeps indoors and is there when it rains. Sputum is carelessly deposited on the ground, which serves as the floor, and babies crawl around on this ground. It is obvious that the infant is brought into very close contact with foci of infection.

The reports to the League of Nations also indicate that gonorrhea is widespread. In 1928-29, 297 males and 145 females were treated and more than half of the cases from the whole of the Mandated Territory were in New Ireland.[39] The report for 1924-25 says that "The central campaign of the year was that devoted to the combatting of gonorrhea. Over a thousand natives in all were treated for the disease, but owing to the lack of funds the campaign was unable to be pushed to a satisfactory conclusion." [40] Since gonorrhea is usually held to be the cause of a large percentage of sterility,[41] it is possible that this disease might be a cause for the increasing sterility among these women.

Syphilis is not mentioned in the Reports to the League of Nations, but this does not necessarily mean that the natives do not have the disease. The reports on autopsies performed give such causes of death as tuberculosis, dysentery, pneumonia, tropical ulcers, enteric fever, miscellaneous septic conditions, etc. It is quite possible that a native suffering from any of these might have syphilis at the same time, but that it might not be considered the cause of death. Particularly might this be so, since it is common knowledge that syphilis exists among the natives, even if one can get no statistics on the matter. If three or four boys leave their village to work in the white man's capital, or on some large plantation and return with syphilis, it would not take long for the disease to spread, in view of their rather promiscuous sexual life. The

[39] Report to the Council of the League of Nations, etc., 1928-29, p. 26.

[40] *Ibid.*, 1924-25, p. 17.

[41] Graves, W. P.—Gynecology, *Philadelphia*, 1928, p. 668. "Gonorrhea, of all the inflammations that attack the tubes (fallopian) is by far the most destructive of fertility."

possible connection of syphilis with reducing the birth rate and increasing the number of deaths due to accidents of pregnancy has been noted.

The difficulty with most theories accounting for the decline in native populations is that there is very little factual material to prove them. But it would seem from statistics presented in this study made through genealogies, that one small group of a declining people is being exterminated because a large per cent of their offspring are dying in infancy and therefore do not have a chance to reproduce themselves. The physiological causes for this increase in infant mortality are suggested only tentatively, since there are no adequate medical records, and because the writer is not a physician and could make no medical investigation. However, a thorough study of the effect of introduced diseases might reveal much information on the causes for the decline of these people.[42]

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[42] I am indebted to M. Powdermaker for making the charts accompanying this article.

MARRIAGES IN THE STATE OF NEW YORK WITH SPECIAL REFERENCE TO NATIVITY[1]

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The presentation, before the Vital Statistics Section of the American Public Health Association, of a paper on marriages seems to require an explanation, if not apology. The discussions at our annual meetings deal with births, sickness, and deaths, their rates and trends, methods of registration. The object is to measure conditions as they are now and directly or indirectly supply the active workers in the field with guidance for their future activities. How can a paper on marriage justify its place on our program?

Marriages are, and this is not altogether facetious, at the basis of vital statistics. Without marriages there would be no births and, eventually, no sickness, no deaths. They are an integral and permanent phenomenon in the life of any human group. Even in our age of flux, it is the form of marriage and not its substance that is being attacked and defended. Although the proportion of marriages which end in divorce is increasing, in the majority of cases remarriage follows divorce.[2] The attacks upon the institution of marriage by certain lay philosophers are of no lasting significance when one thinks of Strindberg, who, notwithstanding his disillusionment, succumbed three times; of Tolstoy, whose destructive criticism of marriage coincided with his own happy alliance. We have, also, Weininger, whose "Sex and Character" was responsible for the mental suffering of many young women in Germany and other countries; but suicide in his twenty-fourth year indicates that the arguments were not those of a sane man. And if we

[1] Read before the Vital Statistics Section of the American Public Health Association at the Fifty-Ninth Annual Meeting at Fort Worth.

[2] I. M. Rubinow estimates that "more than 90 per cent of divorcés marry again." After Divorce—What?, *New Republic*, July 19, 1930.

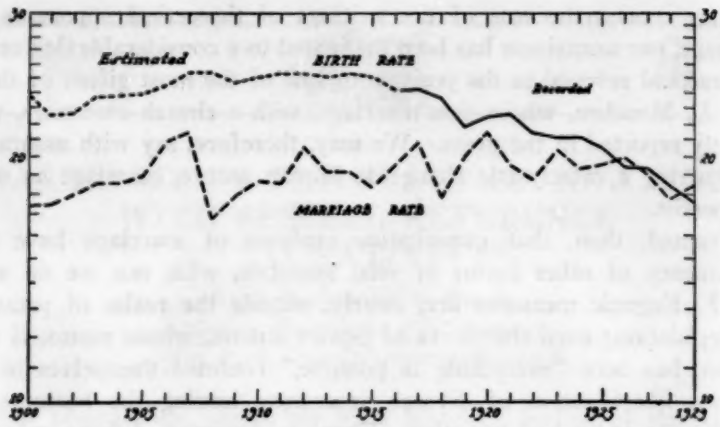
had any concern because of the writings of theoretical opponents of marriage, our uneasiness has been dissipated to a considerable degree by the practical reversal in the position of one of the most gifted of them —H. L. Mencken, whose own marriage, with a church ceremony, was recently reported in the press. We may, therefore, say with assurance that barring a cataclysmic change in human nature, marriage as such will persist.

Granted, then, that quantitative analyses of marriage have the permanency of other forms of vital statistics, what can we do with them? Eugenic measures are, clearly, outside the realm of present-day legislation; even the rulers of Soviet Russia, whose motto, if unspoken, has been "everything is possible," confined themselves to an extreme liberalization of divorce procedure, leaving the business of marriage to individual initiative. There is, however, definite value in the mere statement of important facts, even though we would do nothing about them.

Morbidity and mortality are functions of many variables; racial stock is undoubtedly one of them. Now that the era of free immigration has come to an end, the ingredients out of which an American type, biologically distinct, will be moulded in the course of years, are numerically defined. Marriage statistics measure, in a sense, the valences of the racial elements participating in the nation-building process.

TREND OF THE MARRIAGE RATE

The movement of the marriage rate in the State of New York during the thirty-year period 1900-1929 does not disclose any marked trend, either upward or downward, the average annual per cent increase in the rate being only 0.2 per cent. The marked fluctuations in the rate (Graph 1) are largely responses to outstanding changes in social and economic conditions. The highest rate (21.6) was recorded in 1920, the marriages in that year including, undoubtedly, many that were postponed on account of war conditions. The next highest (21.5) was that of 1907—the third successive year of an unusually favorable state of business. The panic during the last quarter of that year and the depression of the year 1908 resulted in a precipitous drop of 22 per cent to the lowest rate (16.8) recorded since 1898. Our entrance into the World War was, clearly, an important cause of the low rate of 1918, which was 14 per cent below that of the preceding year.



GRAPH 1. BIRTH RATE AND MARRIAGE RATE, PER 1,000 POPULATION NEW YORK STATE, 1900-1929

It is interesting to compare the curve of the marriage rate with that of the birth rate (Graph 1). Since the registration of births in many sections of the State became practically complete only about 1917, the birth rates shown on the chart prior to that year are estimates considerably in excess of the recorded rates. In 1929 the number of births was greater than the estimated number in 1900 by 45,058, while the difference between the number of persons married (which is, of course, double the number of marriages) in these two years was 102,838. The birth rate in 1929 (17.5) was *less* than the estimated rate in 1900 (23.7) by 26 per cent, while the marriage rate in 1929 (18.4) was *greater* than the 1900 rate (17.4) by 6 per cent.

The curve of the birth rate exhibits two definite trends—upward from 1900 to 1914, the increase averaging 0.8 per cent a year; and downward, from 1914 to the present, at an annual average decrease of 2.2 per cent. The corresponding figures for the marriage rate were + 0.6 per cent and — 0.2 per cent. In other words, while in 1914-1929 the number of births in the State declined both absolutely and relatively, the number of marriages practically kept pace with the increase in population.

The marriage rate among the foreign-born population of the State is higher than among the native-born. In 1929 the rates, in terms of the marriageable population (single, widowed, and divorced persons 15 years of age and over), were 88.0 and 63.7. These figures are, how-

ever, subject to a considerable degree of error, since the estimates of population were based on the censuses of 1910 and 1920. To eliminate, insofar as possible, errors in the population estimates, we have computed the average annual rates for 1919-1921, a triennium having the census year 1920 in the center. The rates were found to be 86.3 for the foreign-born and 59.9 for the rest of the population.

With the curtailment in the volume of immigration, the number of foreign-born will, of course, diminish. The present foreign-born population will grow older and the death rate among them will rise; the number of newcomers will not be sufficient to overcome this natural loss. As a matter of fact, even now, deaths among the foreign-born are more numerous than the annual increment in this class of the population. From July 1, 1924 to June 30, 1927 the net white immigration for the entire country totalled 699,628; during the three calendar years 1925-1927 there were 760,894 deaths of foreign-born. With a decrease in the proportion which the foreign-born form of the total population, it is, therefore, logical to expect that the total marriage rate will move downward, at least until the weight of their higher marriage rate is eliminated.

MOVEMENT OF THE INTERMARRIAGE RATE

The degree to which immigrants blend with the native population has, for years, been considered in certain circles a numerical test of the desirability or undesirability of this or that stock. A group which intermarries largely with its own people was looked upon as clannish and, therefore, rather poor stuff as nation-making material. The following table pictures conditions from this angle in the State, exclusive of New York City (the information for the City not being available) in 1916-1929.

Let us look at some of the early years, say, the triennium 1916-1918. Here we find that for every hundred foreign-born women who married native-born men, 278 married foreign-born men; among the grooms the corresponding proportion was 162. Inspecting the figures for the several indicated racial groups, we find that marriages to foreign-born were outstandingly numerous among immigrants from Austria, Hungary, Italy, Poland, Russia. Thus, for 100 marriages to native-born men, 2,547 Italian women married foreign-born men; the corresponding ratio for Hungarian women being 1,124; for Polish women, 1,097; Austrian, 925; and Russian, 889. At the same time the ratio for

TABLE 1

Marriages to foreign-born per 100 marriages to native-born by country of birth of brides and grooms: State of New York (exclusive of New York City), 1916-1929

COUNTRY OF BIRTH	1916-18	1919	1920	1921	1922	1923	1924	1925	1926	1927	1928	1929
						BRIDES						
Total	26	23	21	23	22	22	22	22	21	20	20	19
United States	11	11	10	10	11	11	12	13	12	12	12	12
Total foreign	278	236	209	263	227	190	175	169	160	135	135	137
Austria	925	560	319	468	222	283	250	200	222	124	166	135
Canada	44	49	44	42	50	49	61	64	66	59	54	59
Denmark, Norway, Sweden	*	114	124	144	176	122	177	190	175	147	203	211
England, Scotland, Wales	75	73	63	71	80	81	78	90	82	66	87	100
Germany	105	83	76	89	91	138	125	208	251	257	243	342
Hungary	1,124	608	285	464	481	262	424	218	245	139	126	188
Ireland	111	89	90	95	102	84	86	90	108	111	128	122
Italy	2,547	1,993	1,773	2,053	1,221	1,103	814	630	505	370	295	263
Poland	1,097	695	438	533	478	385	276	298	264	182	155	145
Russia	889	658	423	499	285	260	256	237	190	233	193	168
						GROOMS						
Total	21	17	16	18	16	16	17	16	15	15	14	14
United States	6	6	6	5	5	6	7	7	7	7	7	6
Total foreign	162	120	114	142	119	107	100	91	87	80	76	75
Austria	484	242	184	250	177	168	118	104	125	66	86	77
Canada	38	44	36	43	45	44	52	53	58	57	46	47
Denmark, Norway, Sweden	*	79	85	63	79	69	88	95	88	83	71	98
England, Scotland, Wales	52	51	49	53	54	68	69	81	68	57	59	68
Germany	64	57	46	55	53	84	101	161	176	179	187	169
Hungary	730	353	258	217	315	242	304	144	112	90	98	86
Ireland	145	94	111	114	108	101	98	103	140	135	169	131
Italy	231	168	184	230	174	135	112	81	75	66	59	55
Poland	360	204	145	181	178	163	132	118	115	100	88	85
Russia	353	221	195	193	139	158	149	142	114	127	99	90

* Data not available.

the Canadians was 44, the British 75, indicating a preponderance of marriages to native-born, while among the Germans and Irish the marriages to foreign-born were only slightly in excess of those to native-born, the ratios being 105 and 111 respectively.

Among men, marriages to native-born were more common than among women, but here, too, natives of northwestern Europe and Germany were apparently less "clannish" than those of southern and eastern Europe.

If we examine the trend during the succeeding eleven years, what do we see? The startlingly high ratio of marriages to foreign-born among the Italian women drops from 2,547 to only 263 in 1929; the next highest ratio, that of the Hungarian group, 1,124, becomes only 188; likewise, marriages of Polish women to foreign-born in 1916-1918 were eleven times as numerous as the marriages to native-born, while in 1929 they were barely one and one-half times that number. On the other hand, the ratio among the German women more than trebled—from 105 to 342—and was the highest of any group in 1929. The Scandinavian ratio, 114 in 1919, the earliest available, has now practically doubled and there has been a similar though smaller increase in the Canadian and British figures. In the column of grooms we note that in 1929 the marriages to foreign-born were more numerous than to native-born in only two groups—the Germans and the Irish.

Grouping the foreign-born population into two large classes: one comprising natives of Great Britain, Ireland, the Scandinavian countries, Germany, and Canada; the other, natives of Austria, Hungary, Italy, Poland, Russia, we find (see Graph 2) that among the grooms of the former class the relative number of marriages of foreign-born *increased* from 59 in 1916-1918 to 84 in 1929, while in the second class the ratio *decreased* from 314 to 65. Among the brides we note the same movement—a *rise* in one curve, from 73 to 116, and a *decline* in the other, from 1,253 to 197.

What has happened to bring about such marked change in the marital tastes of the several groups? The answer is self-evident. With the decrease in the volume of immigration, the supply of foreign-born brides and grooms was correspondingly depleted. Therefore, the foreign-born, in increasing numbers, were obliged to turn their eyes and hearts to native-born. The striking increase in the German ratio, and to a lesser extent in the British, is a direct consequence of the existing

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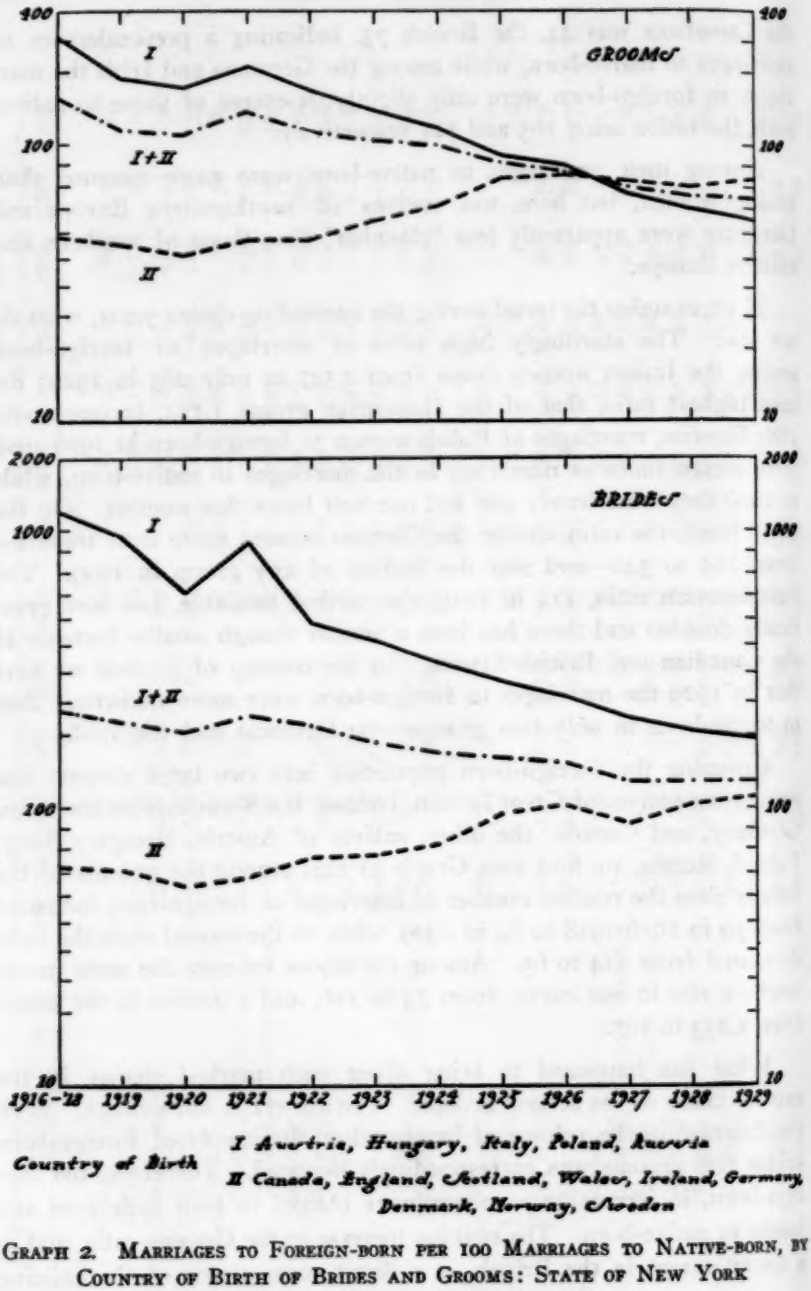

GRAPH 2. MARRIAGES TO FOREIGN-BORN PER 100 MARRIAGES TO NATIVE-BORN, BY COUNTRY OF BIRTH OF BRIDES AND GROOMS: STATE OF NEW YORK (EXCLUSIVE OF NEW YORK CITY), 1916-1929

immigration regulations, which assign the largest quotas to natives of Great Britain and Germany.

Before we leave this topic we shall examine the movement of the ratio for the entire foreign group. In the column of brides this ratio declined from 278 in 1916-1918 to 137 in 1929, a reduction of 50.7 per cent; the ratio among grooms dropped from 162 to 75, a reduction of 53.7 per cent. The downward movement of these figures was quite uniform, with the exception of 1921. The increase in that year was undoubtedly due to a provision in the Immigration Act of May 19, 1921, by which fiancées of citizens, or of aliens who had declared their intention of becoming citizens, were given preference when applying for admission to this country.

MARRIAGES ACCORDING TO NATIVITY OF BRIDES AND GROOMS AND THEIR PARENTS

We have thus found that the number of marriages of our foreign-born to native-born persons is increasing from year to year. To what extent are these marriages in which one of the partners is native-born alliances of different or of the same racial strains? To answer this question we have tabulated the marriage returns for 1927-1929 according to the nativity of brides and grooms and their parents on a relative base. These tables enable us to analyze not only mixed marriages, but also those in which both the bride and the groom are of the first native-born generation. Further investigation is impossible because the marriage records do not state the country of birth of grandparents. We have, therefore, the following large classes: native-born brides and grooms of native parentage; of mixed parentage, grouped according to the country of birth of the foreign-born parent; of foreign parentage, according to the country of birth of the father (which, as we shall see later, is in practically all cases also that of the mother); and the foreign-born brides and grooms, according to their country of birth.

Marriages of white persons recorded in the three-year period totalled 136,381. Of the grooms, 83.6 per cent were native-born and 16.4 per cent foreign-born. The proportion of native-born among brides was greater—87.6 per cent, the foreign-born brides representing 12.4 per cent of the total.

In 78.4 per cent of all marriages, both the bride and the groom were native-born; in 21.6 per cent of the marriages either the bride or the groom, or both, were foreign-born; in 7.1 per cent they were both

TABLE 2

Marriages by country of birth of white grooms and their parents according to country of birth of white brides and their parents, per 100 marriages in each group: State of New York (exclusive of New York City), 1927-1929

COUNTRY OF BIRTH OF GROOMS AND THEIR PARENTS	COUNTRY OF BIRTH OF BRIDES AND THEIR PARENTS							
	Native-born Brides						Foreign-born Brides	
	Total	Native Parentage	Foreign Parentage		Mixed Parentage		Same Country	Other Country
			Same Country	Other Country	Same Country	Other Country		
ALL GROOMS	87.6	56.3	20.1		11.0		12.4	
Native-born grooms	93.7	63.3	18.3		11.9		6.3	
Native parentage	95.5	73.7	10.5		11.1		4.5	
Foreign parentage (country of birth of father)	88.7	35.0	41.4		12.1		11.3	
Austria	87.7	22.9	25.9	29.7	.9	8.2	3.2	9.0
Canada	86.0	51.9	6.9	12.8	6.5	7.7	10.6	3.4
Denmark, Norway, Sweden	92.4	48.7	16.0	12.3	3.4	11.7	3.1	4.5
England, Scotland, Wales	90.3	57.1	4.6	14.5	4.7	9.2	3.7	6.0
Germany	90.5	47.3	12.8	14.4	6.9	8.7	3.2	6.3
Hungary	88.0	25.9	25.4	28.0	.7	8.0	4.2	7.8
Ireland	91.1	50.8	10.7	12.8	8.1	8.5	3.3	5.6
Italy	86.8	18.9	49.2	10.8	3.3	4.4	9.7	3.5
Poland	89.1	11.3	56.7	12.0	6.0	2.8	8.3	2.6
Russia	83.7	13.9	40.6	19.8	3.6	5.5	8.5	7.8
Other countries	—	—	—	—	—	—	—	—
Mixed parentage (country of birth of foreign-born parent)	92.9	58.1	19.1		15.5		7.1	
Austria	96.0	45.6	13.4	28.2	1.3	7.4	—	4.0
Canada	91.7	62.0	3.8	9.8	7.4	8.5	5.8	2.5
Denmark, Norway, Sweden	94.7	61.1	7.9	11.1	3.2	11.5	1.4	4.0
England, Scotland, Wales	93.3	64.6	2.1	12.4	4.0	10.1	2.0	4.6
Germany	93.5	58.6	8.4	10.2	7.3	8.7	1.2	5.3
Hungary	93.0	30.2	9.3	25.6	4.7	23.3	—	7.0
Ireland	93.3	57.3	6.6	12.7	6.3	10.0	1.6	5.1
Italy	93.2	36.7	28.6	16.4	4.4	7.0	4.2	2.6
Poland	91.2	14.5	45.9	11.1	12.3	7.1	6.6	2.3
Russia	88.0	26.9	24.6	19.2	9.0	7.8	5.4	6.6
Other countries	—	—	—	—	—	—	—	—
Foreign-born grooms	56.5	20.3	29.5		6.6		43.5	
Austria	56.8	15.3	18.3	17.1	.7	5.3	22.1	21.3
Canada	66.7	42.1	4.3	8.8	5.4	6.0	26.1	7.2
Denmark, Norway, Sweden	54.3	23.8	15.1	7.5	2.2	5.1	34.9	10.8
England, Scotland, Wales	62.0	36.6	3.5	11.4	2.9	7.1	26.1	11.9
Germany	36.0	15.3	9.0	5.4	3.3	2.8	56.4	7.6
Hungary	52.3	14.3	18.8	12.8	1.2	5.2	34.7	13.1
Ireland	41.2	19.7	8.2	5.6	4.1	3.7	48.4	10.4
Italy	62.5	7.0	48.7	3.4	1.6	1.6	34.2	3.3
Poland	52.4	3.8	36.3	8.2	2.7	1.5	39.4	8.1
Russia	49.0	6.7	23.9	14.3	1.7	2.0	33.5	17.5
Other countries	—	—	—	—	—	—	—	—

TABLE 3

Marriages by country of birth of white brides and their parents according to country of birth of white grooms and their parents, per 100 marriages in each group: State of New York (exclusive of New York City), 1927-1929

COUNTRY OF BIRTH OF BRIDES AND THEIR PARENTS	COUNTRY OF BIRTH OF GROOMS AND THEIR PARENTS							
	Native-born Grooms						Foreign-born Grooms	
	Total	Native Parentage	Foreign Parentage		Mixed Parentage		Same Country	Other Country
			Same Country	Other Country	Same Country	Other Country		
ALL BRIDES	83.6	54.8	18.0		10.5		16.4	
Native-born brides	89.5	59.8	18.3		11.2		10.5	
Native parentage	94.1	71.8	11.2		10.9		5.9	
Foreign parentage (country of birth of father)	76.0	28.7	37.1		10.0		24.0	
Austria	78.6	23.4	20.6	25.7	1.4	7.3	7.3	14.1
Canada	85.1	49.6	6.7	12.5	7.3	8.9	9.9	5.0
Denmark, Norway, Sweden	83.3	46.3	15.0	10.3	2.9	8.7	11.5	5.2
England, Scotland, Wales	87.0	54.1	5.1	14.0	3.5	10.1	5.8	7.3
Germany	86.8	44.6	14.3	13.4	6.6	7.6	5.0	8.1
Hungary	79.1	24.3	16.8	29.2	.6	8.1	9.7	11.2
Ireland	89.1	46.5	12.2	13.1	7.8	9.3	3.8	7.1
Italy	53.9	8.2	38.7	3.4	1.7	1.8	42.6	3.5
Poland	80.1	14.5	40.0	16.7	3.9	4.6	14.0	5.9
Russia	73.7	11.0	33.9	20.3	2.6	5.8	15.3	11.0
Other countries	—	—	—	—	—	—	—	—
Mixed parentage (country of birth of foreign-born parent)	90.2	55.3	19.9		14.8		9.8	
Austria	88.0	41.4	5.2	28.8	1.0	11.5	2.1	9.9
Canada	89.7	60.1	3.0	10.8	6.7	8.9	5.9	4.4
Denmark, Norway, Sweden	90.5	61.1	7.9	8.8	2.9	9.3	4.1	5.4
England, Scotland, Wales	91.5	62.5	3.0	12.1	3.9	9.9	2.8	5.7
Germany	90.9	55.9	9.9	9.7	7.4	7.9	2.4	6.7
Hungary	76.9	32.3	4.6	26.2	3.1	10.8	6.2	16.9
Ireland	92.6	55.1	8.2	12.3	6.6	10.3	1.7	5.7
Italy	78.5	27.9	32.6	7.9	3.3	6.2	17.2	4.3
Poland	86.3	20.9	34.6	18.1	8.7	3.8	8.5	5.2
Russia	83.2	24.3	27.2	15.6	8.7	6.9	9.8	6.9
Other countries	—	—	—	—	—	—	—	—
Foreign-born brides	42.4	19.8	16.5		6.0		57.6	
Austria	41.7	14.3	7.8	14.7	—	5.0	26.8	31.5
Canada	63.4	37.0	4.5	10.6	4.9	6.3	26.5	10.1
Denmark, Norway, Sweden	35.0	17.7	6.3	5.6	1.1	4.2	57.4	7.7
England, Scotland, Wales	54.7	32.7	2.9	9.9	2.3	6.5	30.1	15.2
Germany	26.5	11.7	7.1	3.9	1.9	1.9	62.7	10.8
Hungary	40.1	17.3	6.2	13.1	—	3.1	39.4	20.1
Ireland	45.4	23.9	6.8	7.1	3.5	3.9	40.3	14.3
Italy	24.5	3.1	18.5	1.9	.6	.5	72.3	3.2
Poland	38.4	6.3	19.0	9.5	1.8	1.8	49.1	12.5
Russia	33.7	6.8	15.3	8.7	1.2	1.7	46.1	20.3
Other countries	—	—	—	—	—	—	—	—

foreign-born, in 5.2 per cent the groom was native-born and the bride foreign-born, and in 9.2 per cent the bride was native-born and the groom foreign-born. Marriages in which both the bride and the groom were of native parentage represented 40.4 per cent of all the marriages, in 7.5 per cent both the bride and groom were of foreign parentage, and in 1.6 per cent they were both of mixed parentage.

Considering the marriages according to general nativity, we find that almost three-fourths of the native-born brides and grooms of native parentage married persons who were also of native parentage, the percentages being 71.8 for the brides and 73.7 for the grooms. Marriages with native-born persons of foreign parentage were slightly over one-tenth of the total marriages in this group, practically equalling the proportion of marriages with persons of mixed parentage. Marriages with foreign-born represented 4.5 per cent of the grooms and 5.9 per cent of the brides.

Native-born brides and grooms of mixed parentage married largely native-born of *native* parentage, the percentages for the brides and grooms being 55.3 and 58.1 per cent respectively; marriages to native-born persons of foreign parentage were next in order, 19.9 and 19.1 per cent; marriages to persons of mixed parentage were third, 14.8 and 15.5 per cent; while those with foreign-born were least numerous, 9.8 and 7.1 per cent.

Among the native-born brides and grooms of foreign parentage, marriages with native-born brides and grooms of foreign parentage were most common, although not a majority, 37.1 and 41.4 per cent. Marriages with native-born of native parentage were next, 28.7 and 35.0 per cent. Among the brides, the proportion of marriages with foreign-born, 24.0 per cent, was more than double the corresponding percentage among the grooms, 11.3. One-tenth of the brides married native-born men of mixed parentage, the corresponding proportion for the grooms being slightly higher, 12.1 per cent.

Thus, among the three groups of native-born persons, marriages with foreign-born were most numerous among those of foreign parentage; among the brides one in four and among the grooms, one in nine, falling in this category. In the group of native-born of mixed parentage, marriages with foreign-born represented one in ten among the brides and one in fourteen among the grooms. Marriages with foreign-born were least numerous among the brides and grooms of

native parentage, representing one in seventeen among the brides and one in twenty-two among the grooms.

Among the foreign-born grooms, 20.3 per cent married native-born women of native parentage; in 6.6 per cent of the marriages the brides were native-born of mixed parentage; in 29.5 per cent, they were of foreign parentage; the remaining 43.5 per cent were foreign-born. The first two percentages for the foreign-born brides were practically the same as for the grooms—19.8 and 6.0—but only 16.5 per cent of the brides married native-born men of foreign parentage.

The proportion of marriages of native-born to foreign-born was definitely higher among brides. Among the native-born of native parentage, the number marrying foreign-born persons represented 5.9 per cent of the brides and 4.5 per cent of the grooms. In the group of native-born of mixed parentage, the percentages were 9.8 and 7.1; in the group of native-born of foreign parentage, they were 24.0 and 11.3. On the other hand, among the foreign-born the proportion marrying native-born persons was lower among the brides—42.4 per cent of them married native-born grooms, while 56.5 per cent of the foreign-born grooms married native-born brides. The main reason for the larger number of intermarriages of foreign-born men as compared with corresponding figures for foreign-born women lies, of course, in the fact that in most of the foreign-born groups of our population there is a preponderance of men. The surplus of men, if they are to marry at all, must marry outside of their own group.

The figures tell us further that when a man of foreign birth chooses a native-born wife she is, in the majority of cases, of foreign parentage, while the numerically largest group of the native-born grooms of foreign-born women are of native parentage. Of the 12,598 native-born brides of foreign-born men, 6,571, or slightly more than half, were of foreign parentage; the native-born of native parentage numbered 4,517, or 36 per cent. Of the 7,154 native-born grooms of foreign-born brides, 3,337, or 47 per cent, were of native parentage; grooms of foreign parentage numbered 2,778, or 39 per cent.

The sub-totals of Table 2 show how many of the brides of foreign birth—or if they were of the first native-born generation, their fathers —were of the same countries of origin as their foreign-born grooms or the fathers of the native-born grooms of the first generation. Arranging these numbers under three heads: native stock, same foreign stock,

and other foreign stock, and relating them to the totals in each group we obtain the following percentages:

TABLE 4

Marriages according to racial stock of brides and grooms per 100 marriages in each group: State of New York (exclusive of New York City), 1927-1929

GENERAL NATIVITY	NATIVE STOCK	SAME FOREIGN STOCK				OTHER FOREIGN STOCK
		Total	Native-born		Foreign-born	
			Mixed Parentage	Foreign Parentage		
GROOMS:			BRIDES			
Native-born						
Native parentage	73.7					26.1
Mixed parentage	58.0	16.6	6.3	7.6	2.7	25.2
Foreign parentage	34.7	38.9	5.2	27.6	6.1	26.2
Foreign-born	20.1	60.3	2.9	22.1	35.3	19.5
BRIDES:			GROOMS			
Native-born						
Native parentage	71.8					28.0
Mixed parentage	55.3	18.5	6.0	8.4	4.1	26.0
Foreign parentage	28.1	46.2	4.0	24.9	17.3	25.4
Foreign-born	20.0	57.1	2.4	9.1	45.6	22.8

N. B. Persons whose country of birth was unknown or not stated are not included in this table.

The divisions indicated in the preceding table are by no means exact. To say that the only persons in this country of truly native stock are the Indians, is tautological. Among the native-born of native parentage there are undoubtedly some of unmixed racial strains akin to the foreign-born of the same strains. And, again, our only criterion for the preceding classification is the country of origin, and this is practically identical with racial stock only for countries with a homogeneous population—as that of Italy, for example; but, with the amount of information in our possession, this is the best we can do and within unavoidable limits of error the deductions which can be drawn from the table are, I believe, worthy of attention.

We first note that the relative number of marriages with "other foreign stock" was practically the same for the three classes of native-born brides and grooms, somewhat more than one-fourth of the marriages in each class. Marriages of the foreign-born with persons of

other foreign stock were relatively less numerous, representing 19.5 per cent of the grooms and 22.8 per cent of the brides.

The degree of intermarriage with persons of native stock increases uniformly from 20 per cent for the foreign-born to over 70 per cent for the native-born of native parentage. For the native-born brides and grooms of foreign parentage the percentages are 28.1 and 34.7. The native-born of mixed parentage, i. e., those having one native-born parent, are more "Americanized" and a majority of their marriages are with persons of native stock. Among the foreign-born, three out of five marriages are with persons of their own stock, either of foreign birth or of immediate foreign origin. The remaining marriages are equally divided among persons of native stock or of foreign stock other than their own.

We shall now examine the marriages of foreign-born according to their country of birth. Grooms who were natives of Italy represented the largest group—5,585. Of their brides, 2,095 were foreign-born—1,909 being natives of Italy and 186 natives of other foreign countries; 2,914 brides were native-born of foreign parentage. Of these, however, almost all, 2,722, had Italian fathers; 178 brides were native-born of mixed parentage, the foreign-born parents of exactly half of this number were natives of Italy, the parentage of five brides was not stated. The remaining 393 Italian grooms had native-born brides of native parentage whose racial origin, for reasons given above, could not be determined. Thus, one or both parents of 2,811 of the 3,490 native-born brides were Italians. Therefore, only 679, or 12 per cent, of the 5,585 Italian grooms married brides who were either of foreign birth or of foreign origin other than Italian, or of native parentage. The latter group was the most numerous and almost certainly some of these brides were of more removed Italian ancestry.

Let us consider another group, also representative of the so-called "new immigration,"—natives of Poland. This group comprised 1,572 grooms; of these, 1,232 married brides who were also natives of Poland or one or both of whose parents were natives of that country. Of the remaining 340 Polish grooms, 59 married native-born brides of native parentage, 152 married native brides of foreign or mixed parentage whose fathers were not natives of Poland, and 128 married foreign-born brides natives of countries other than Poland. In the latter group 48 were natives of Russia, 22 of Austria, and 12 of Germany. It is more than likely that many of these brides were of the same racial

stock as the grooms. Similarly, of the 152 brides of foreign or mixed parentage, and apparently not of Polish origin, one or both parents of 27 brides were natives of Austria, 43 of Germany, and 40 of Russia. Among the Poles, therefore, marriages outside the group were also relatively few.

Among grooms of a group which settled in this country in considerable numbers at a period antedating the peak of Italian or Polish immigration, we should expect to find a larger number of marriages with native-born women of native parentage. This is a logical consequence of their earlier settlement here, which led to the formation of a more numerous native stock. Of the 2,565 German grooms, for example, 393, or 15 per cent, married native-born women of native parentage as compared with 7 per cent of the Italians and 4 per cent of the Poles. Among the remaining marriages in which the groom was of German birth, in seven out of ten cases the bride was also of German birth. The brides of 371 grooms were native-born of foreign parentage, the fathers of 232 being of German birth; 158 brides were of mixed parentage, 85 of them having a German parent. In the British group—natives of England, Scotland, and Wales—we find 2,715 grooms. Since the British were among the earliest arrivals on this continent, it is natural that a large percentage of British grooms should marry native-born women of native parentage. In 1927-1929 they numbered 995, or 37 per cent of the total. There were 405 British grooms who married native-born brides of foreign parentage; of these the parents of 95 were British. Grooms who married native-born brides of mixed parentage numbered 272, the parents of 78 brides being British. British grooms marrying foreign-born brides numbered 1,033; the majority of the brides (709) were of British birth, 155 were Canadians, and 82 Irish.

In our discussion of the foreign-born grooms, we stressed the relatively small proportion of racial intermarriages. This observation is true even in stronger form for all groups of the brides with the exception of the Irish. Thus, 72.3 per cent of the Italian-born brides married Italian men, the corresponding proportion for the Italian grooms being only 34.2 per cent. While 39.4 per cent of the Polish-born grooms married natives of Poland, the grooms of 49.1 per cent of the Polish-born women were natives of the same country. On the other hand, 48.4 per cent of Irish-born grooms married Irish women; of the brides who were natives of Ireland, only 40.3 per cent married natives of the same country.

It may be of interest to examine, in passing, the nativity of the foreign-born parents of the native-born brides and grooms. Because of lack of space, we are not presenting detailed tables. When the countries of birth of the foreign-born parents of the native-born brides are correlated, we find that in the majority of instances they were the same. The combined figures for 1928 and 1929 show that the fathers of 17,438 brides were natives of the several countries considered in this paper; in 15,926 cases, or 91 per cent, the fathers and mothers were natives of the same country. Similarly, the fathers of 15,703 native-born grooms of foreign parentage were natives of the countries shown in our tables. In 14,317 cases, or 91 per cent, the fathers and mothers were natives of the same country. Since racial lines almost everywhere transcend political divisions, these percentages undoubtedly underestimate the actual ratio of marriages within the indicated groups. Thus, for example, of the 1,123 native-born brides whose fathers were of British birth, 821 had British mothers; at the same time, we find that 109 of the brides had mothers of Irish birth and 96 had mothers of Canadian birth. Undoubtedly, a certain proportion of these 205 mothers were racially akin to their British-born husbands.

INTERMARRIAGE IN URBAN AND RURAL AREAS OF THE STATE

In order to determine whether there is any difference in the degree of intermarriage in urban and rural areas we have tabulated the marriages recorded in 1927-1929 in these two divisions of the State, exclusive of New York City, according to residence of the bride.[8]

The number of white brides who were residents of the State totalled 117,725; residents of other states numbered 18,656. The percentage of marriages of foreign-born persons to native-born was higher in the rural than in the urban area, the contrary being true for marriages of native-born to foreign-born. This apparently contradictory condition can be explained by the fact that in the rural districts, where there are relatively fewer foreign-born, a large percentage of those who marry must choose native mates. But the natives whom they marry form only a small proportion of the total native population. In the urban

[8] The laws of the State of New York provide that a marriage license must be secured "from the town or city clerk of the town or city . . . . in which the woman to be married resides." Our tables, therefore, are of necessity based on the residence of the bride only.

TABLE 5

Marriages of urban and rural residents by country of birth of white brides and grooms, per 100 marriages in each group: State of New York (exclusive of New York City), 1927-1929

COUNTRY OF BIRTH	GROOMS MARRYING BRIDES NATIVES OF:			BRIDES MARRYING GROOMS NATIVES OF:		
	United States	Same Foreign Country	Other Foreign Country	United States	Same Foreign Country	Other Foreign Country
			URBAN			
United States	92.1	7.9		86.3	13.7	
Total foreign	53.8	46.1		38.6	61.4	
Austria	52.6	23.7	23.7	40.0	27.0	33.0
Canada	69.7	22.8	7.5	65.9	22.8	11.3
Denmark, Norway, Sweden	51.4	39.6	9.0	26.5	68.2	5.2
England, Scotland, Wales	60.0	28.6	11.5	51.4	33.5	15.2
Germany	30.0	62.4	7.6	21.6	68.2	10.2
Hungary	49.3	37.3	13.4	35.6	44.8	19.0
Ireland	37.7	51.8	10.5	41.3	45.5	13.1
Italy	60.1	37.3	2.6	22.8	74.7	2.6
Poland	51.5	40.6	7.9	37.4	51.5	11.1
Russia	45.6	36.9	17.5	30.3	47.9	21.7
			RURAL			
United States	95.2	4.8		91.6	8.4	
Total foreign	62.4	37.6		47.4	52.6	
Austria	62.1	20.7	17.2	42.3	28.2	29.5
Canada	81.7	13.9	4.3	75.0	17.1	7.8
Denmark, Norway, Sweden	55.3	30.0	14.7	39.8	47.8	12.4
England, Scotland, Wales	68.9	21.6	9.5	61.7	26.1	12.2
Germany	41.6	50.7	7.7	31.1	57.4	11.4
Hungary	58.8	27.1	14.1	47.0	27.7	25.3
Ireland	43.8	47.8	8.4	48.4	36.9	14.7
Italy	66.1	29.1	4.8	25.9	69.0	5.1
Poland	54.4	38.6	7.0	38.2	47.8	14.0
Russia	54.3	29.1	16.7	35.0	49.6	15.3

districts, where there is a large foreign population, the number of those who marry native-born persons is numerically larger but proportionately smaller than in the rural districts; the number of native-born persons whom they married forms, however, a larger percentage of the native urban population. Similarly, the proportion which the marriages within a group of foreign-born forms of the total number of marriages of the

men and women in that group is determined by the relative number of males and females. Generally speaking, then, the chance of a native marrying a foreign-born person is greater in the city, while the chance of a foreign-born person marrying a native is greater in the country.

MARRIAGES OF COLORED PERSONS

In 1919-1929, the longest period for which the information is available, there were recorded in the State of New York, exclusive of New York City, the marriages of 17,781 Negroes and 650 "other colored" persons—Chinese, Japanese, Indians, etc. Negro brides numbered 8,800. Of their grooms, 8,706 were Negroes, 9 "other colored," and 85 white—of the latter, 57 were native-born and 28 foreign-born. Thus, in about one per cent of the marriages Negro women married white men.

Negro grooms numbered 8,981. Of their brides, 8,706 were Negroes, 13 "other colored," and 262 white—of whom 237 were native born and 25 foreign-born. In 2.92 per cent of these marriages, Negro men married white women.

In the group of "other colored," we find 318 brides. Of their grooms, 250 belonged to the same group of "other colored," 13 were Negroes, and 55 white—41 native-born and 14 foreign-born. Marriages with whites, therefore, represented 17.29 per cent of the marriages in this group. The grooms numbered 332; of their brides, 250 were "other colored," 9 Negroes, and 73 white—58 native-born and 15 foreign-born. Marriages with whites represented 21.99 per cent of all the marriages in this group.

Table number six shows the marriages of colored persons in the State, outside of New York City, and in its urban and rural subdivisions —the latter relating only to residents of these sections of the State.

Marriages of Negro women with white men were slightly more numerous in the rural part of the State, while marriages of Negro men with white women were more common in the urban territory. In the urban area 0.95 per cent of the marriages of Negro women and 3.36 per cent of the marriages of Negro men were to white persons, while in the rural part of the State the corresponding proportions were 0.99 and 2.00 per cent respectively.

Marriages of "other colored" persons with whites were relatively more numerous in the urban than in the rural area. In the former, 22.36 per cent of the brides and 37.62 per cent of the grooms married

TABLE 6

Marriages of colored persons: State of New York (exclusive of New York City), 1919-1929

	NUMBER					PER CENT			
		White				White			
	Total	Native-born	Foreign-born	Negro	Other Colored	Native-born	Foreign-born	Negro	Other Colored
TOTAL									
Brides					Grooms				
Negro	8,800	57	28	8,706	9	.65	.32	98.93	.10
Other colored	318	41	14	13	250	12.89	4.40	4.09	78.62
Grooms					Brides				
Negro	8,981	237	25	8,706	13	2.64	.28	96.94	.14
Other colored	332	58	15	9	250	17.47	4.52	2.71	75.30
URBAN									
Brides					Grooms				
Negro	5,604	37	16	5,546	5	.66	.29	98.97	.09
Other colored	85	12	7	8	58	14.12	8.24	9.41	68.24
Grooms					Brides				
Negro	5,747	174	19	5,546	8	3.03	.33	96.50	.14
Other colored	101	32	6	5	58	31.68	5.94	4.95	57.43
RURAL									
Brides					Grooms				
Negro	2,619	16	10	2,589	4	.61	.38	98.85	.15
Other colored	227	24	12	5	186	10.57	5.29	2.20	81.94
Grooms					Brides				
Negro	2,647	49	4	2,589	5	1.85	.15	97.81	.19
Other colored	213	17	6	4	186	7.98	2.82	1.88	87.32

N. B. Urban and rural are exclusive of New York City and of other states.

white persons, while in the rural part of the State the corresponding proportions were 15.86 and 10.80.

SUMMARY

The number of marriages in the State of New York in the thirty-year period 1900-1929 has just kept pace with the growth of population —the annual variation in the rate being only + 0.2 per cent.

The marriage rate of the foreign-born is greater than that of the native-born. Since the proportion of the foreign-born in the entire population is decreasing, the total marriage rate will, in all probability, move downward, at least until the weight of their higher marriage rate is eliminated.

A study of the marriage statistics of the State, exclusive of New York City, showed that in the early years of the period 1916-1929, immigrants from southern and eastern Europe intermarried with the native population to a much lesser degree than those from northwestern Europe and Germany. With the decrease in the volume of immigration, marriages of the former to native-born have become more numerous: the relative number of marriages in which the bride is foreign-born and the groom native-born is, at present, six times as great as only a decade ago, while the proportion of alliances in which the groom is foreign-born and the bride native-born is now actually greater than in the group comprising natives of Canada, northwestern Europe and Germany.

In 1927-1929, in the three large classes of native-born persons the proportion of marriages with foreign-born was greatest among those of foreign parentage, followed by those of mixed parentage, and least among persons of native parentage. Marriages with foreign-born were definitely higher among women.

Among foreign-born men, the larger proportion of marriages was with foreign-born women, followed in numerical order by marriages with native-born of foreign parentage, native parentage, mixed parentage. Among foreign-born women, the nativity of their grooms was in the following order: foreign-born, native-born of native parentage, foreign parentage, mixed parentage. The majority of the native-born brides of foreign-born men were of foreign parentage, while the numerically largest class of native-born grooms of foreign-born women were of native parentage.

N. B. Urban and rural are exclusive of New York City and of other states.

Among the foreign-born, three out of five marriages were with persons of the same country of birth or immediate foreign origin. The remaining marriages were equally divided between persons of native parentage and of foreign stock other than their own. Among the intermarriages of the latter type, the following combinations prevailed:

Country of Birth of Groom	*Country of Birth of Bride*
Austria	Poland and Russia
England, Scotland, Wales	Canada and Ireland
Germany	Austria
Hungary	Austria, Germany, and Russia
Ireland	Canada, England, Scotland, Wales
Poland	Austria
Russia	Austria and Poland

Many of these alliances were undoubtedly intraracial.

The proportion of marriages of foreign-born with native-born persons was greater in the rural area, the contrary being true for marriages of native-born to foreign-born.

Marriages with white persons represented about one per cent of the marriages of Negro women and three per cent of the marriages of Negro men.

RACIAL DIFFERENCES IN MORTALITY AND MORBIDITY

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In the course of a recent field study among the Chemehuevi and Mohave Indians of western Arizona the opportunity presented itself to secure mortality records of a rather unusual character.[1] The present paper concerns itself with an analysis of the Chemehuevi and Mohave data, and also with a comparison based on figures in the annual mortality reports of the United States Census Bureau of the relative mortality of native-born whites, Indians and negroes.

The data on the Mohave and Chemehuevi Indians were drawn from the records of the Colorado River Indian Agency at Parker, Arizona and extend over a period of twenty years (1910-1930). During this period 337 deaths were recorded on the reservation and the diagnoses of the cause of death were all made by the same physician. It is thus reasonable to suppose that these diagnoses are more consistent than would have been the case had several different physicians been in residence at different times during the period. In addition, the ages of the deceased were more accurately known than is usual in the case of Indians. While this accuracy naturally does not extend into the older age groups to the same degree, it is safe to say that the ages of all those under thirty are accurate enough to compare directly with statistics on white deaths, and that the margin of error in the older ages is small.

Table 1 gives the deaths of the Mohave-Chemehuevi Indians grouped by sex in standard five-year age intervals and also the percentage of the total deaths by sex occurring at each age interval. For purposes of comparison the data drawn from the Census Bureau reports for whites,

[1] This work was done while the author was a National Research Council Fellow under the sponsorship of Dr. Clark Wissler of the Institute of Human Relations at Yale University. The expenses of the field study were borne by the Institute.

TABLE 1

Mortality of full blood Mohave and Chemehuevi Indians for the 20 year period 1910-1930. (Exclusive of stillbirths.)

	FREQUENCY			PER CENT OF TOTAL		
	Male	*Female*	*Both*	*Male*	*Female*	*Both*
0-1	34	38	72	20.1	22.6	21.3
1-4	17	13	30	10.1	7.7	8.9
0-4	51	51	102	30.2	30.3	30.2
5-9	4	6	10	2.4	3.6	3.0
10-14	5	4	9	2.9	2.4	2.6
15-19	11	14	25	6.5	8.3	7.4
20-24	12	10	22	7.1	5.9	6.5
25-29	8	7	15	4.7	4.2	4.5
30-34	6	6	12	3.5	3.6	3.5
35-39	3	8	11	1.8	4.8	3.3
40-44	4	5	9	2.4	2.9	2.6
45-49	8	3	11	4.7	1.8	3.3
50-54	12	8	20	7.1	4.8	6.0
55-59	8	5	13	4.7	3.0	3.9
60-64	12	10	22	7.1	5.9	6.5
65-69	10	10	20	5.9	5.9	5.9
70-74	5	4	9	3.0	2.4	2.7
75-79	4	6	10	2.4	3.6	3.0
80-84	4	7	11	2.4	4.2	3.3
85-89	1	2	3	0.6	1.2	0.9
90-94	1	2	3	0.6	1.2	0.9
Total of all ages	169	168	337			

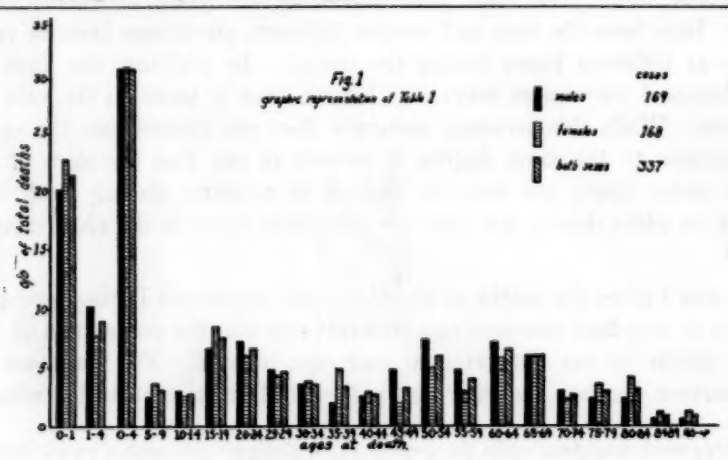

FIG. 1. PERCENTAGE AGE DISTRIBUTION OF DEATHS OF MOHAVE AND CHEMEHUEVI INDIANS, BY SEX.

Indians and negroes have been treated in the same way. These percentages may also be read as deaths per thousand deaths by ignoring the decimal point. For example, 20.1 per cent of the total male deaths occurred in the first year in Table 1, but this may also be read as 201 male deaths per thousand male deaths at all ages. Figure 1 is a graphic representation of Table 1.

There are three major differences between the above distribution and that for the native-born white population. The infant mortality of the Indians is considerably greater than that of the whites, and a larger proportion of white deaths takes place in the age intervals above fifty. But the most striking difference is the relatively greater mortality among Indians in late adolescence and early maturity. This latter divergence was predicted by Hrdlicka on the basis of the population figures of the Twelfth Census.[2]

TABLE 2

Deaths in the rural part of the states in the death registration area of the United States. (Exclusive of stillbirths.)

NATIVE-BORN WHITES

				Percentages	
Year	*Male*	*Female*	*Both Sexes*	*M.*	*F.*
1924	208,890	180,979	389,869	53.5	46.5
1925	217,807	187,760	405,567	53.6	46.4
1926	229,938	198,831	428,769	53.6	46.4
Total	656,635	567,570	1,224,205	53.6	46.4

NEGROES

Year	*Male*	*Female*	*Both Sexes*	*M.*	*F.*
1924	42,146	39,934	82,080	51.3	48.7
1925	42,615	40,215	82,830	51.4	48.6
1926	44,663	41,011	85,674	52.1	47.9
Total	129,424	121,160	250,584	51.6	48.4

AMERICAN INDIANS

Year	*Male*	*Female*	*Both Sexes*	*M.*	*F.*
1924	1,337	1,315	2,652	50.4	49.6
1925	1,428	1,333	2,761	51.7	48.3
1926	1,619	1,558	3,177	50.9	49.1
Total	4,384	4,206	8,590	51.0	49.0

[2] Hrdlicka, (A.)—Physiological and Medical Observations among the Indians of the Southwest. B. A. E., Bull., 43, Wash., 1908, 40-41.

In order to check these differences, the mortality records of the Census Bureau have been tabulated for native-born whites, Indians and negroes in the rural part of the continental United States death registration area for the years 1924, 1925 and 1926.[3] The rural section of the death registration area was chosen in order that the environmental conditions might be more similar for the three racial groups.

Table 2 gives the number of deaths by race and sex for these years as well as the percentage of total deaths for each sex. The raw figures for 1926 are somewhat larger than those for the preceding two years because the registration area was enlarged in that year. The percentage figures for each year, however, are approximately the same within each racial group, so that some confidence may be placed in the figures for the three years combined. These show the usual preponderance of male over female deaths, but this sex difference is not the same for each race. Of the total white deaths, 53.6 per cent were males, but only 51.0 per cent of the total Indian deaths were of this sex, a difference of 2.6 per cent. The negro male deaths fall between these two. White male deaths exceeded white female deaths by 7.2 per cent, while the Indian male deaths exceeded females by only 2.0 per cent. Negro male deaths exceeded those of females by 3.2 per cent. Of the 337 Mohave and Chemehuevi deaths in the first table, 51.0 per cent were males, thus checking with the Indian percentages derived from the Census Bureau reports.

Using the data contained in these reports, the percentages of total deaths by sex for native-born whites, Indians and negroes in the rural part of the death registration area have been calculated in five-year age-intervals for the years 1924, 1925 and 1926. As the general trend was the same in each year, the figures for the three years have been combined and are given in Table 3. Figure 2 is a curve of the percentage of the total deaths which occurred in each age-interval for each of the three racial groups. Figure 3 is a graph of the percentage of total deaths per age-interval in each sex for whites. Figures 4 and 5 are similar graphs for negroes and Indians respectively.

The shape of the plot for Indian deaths in Figures 2 and 5 corresponds closely to that of Figure 1 and indicates that the curious rise in

[3] Mortality Statistics. Bureau of the Census, 25th Annual Report, Wash., 1924, p. 129.
Ibid., 26th Annual Report, 1925, p. 43.
Ibid., 27th Annual Report, 1926, p. 41.

TABLE 3

Mortality of native-born Whites, Indians and Negroes in the rural part of the states in the U. S. death registration area for the years 1924, 1925 and 1926 combined. The table shows the percentage of the total deaths at all ages which occur at each age interval. (Exclusive of stillbirths.)

	WHITES			INDIANS			NEGROES		
	M.	*F.*	*Both*	*M.*	*F.*	*Both*	*M.*	*F.*	*Both*
0-1	17.2	14.9	16.1	23.4	18.7	21.1	18.0	15.3	16.7
1-4	5.6	5.7	5.6	13.5	13.9	13.6	6.3	6.2	6.3
0-4	22.8	20.6	21.7	36.9	32.6	34.7	24.3	21.5	23.0
5-9	2.1	2.0	2.1	4.6	4.7	4.6	1.9	2.1	2.0
10-14	1.8	1.5	1.7	4.5	4.0	4.2	2.0	2.2	2.1
15-19	2.5	2.5	2.5	5.3	5.9	5.7	4.3	6.1	4.9
20-24	2.7	3.1	2.9	4.4	5.1	4.7	5.6	7.0	6.3
25-29	2.4	2.9	2.7	3.1	3.7	3.4	4.6	6.0	5.2
30-34	2.5	3.0	2.7	2.5	2.7	2.6	4.1	4.8	4.5
35-39	2.7	3.2	3.0	2.5	3.2	2.9	4.5	5.7	5.1
40-44	3.0	3.2	3.1	2.8	2.5	2.6	4.4	5.3	4.9
45-49	3.6	3.5	3.5	2.7	2.9	2.8	5.1	5.3	5.2
50-54	4.3	4.2	4.3	3.3	2.9	3.1	6.1	5.6	5.9
55-59	5.2	4.8	5.0	3.2	3.1	3.1	4.9	4.2	4.6
60-64	6.7	6.1	6.4	3.7	4.0	3.8	5.3	4.4	4.9
65-69	8.9	8.1	8.4	4.2	4.1	4.2	5.0	4.2	4.6
70-74	9.4	8.9	9.1	4.9	4.2	4.5	5.4	4.1	4.8
75-79	8.7	8.8	8.8	4.2	3.5	3.8	4.2	3.3	3.8
80-84	6.3	7.3	6.8	2.5	3.9	3.3	3.6	3.1	3.3
85-89	3.1	4.2	3.6	1.9	2.3	2.1	2.0	1.8	1.9
90 up	1.3	2.1	1.7	2.8	4.7	3.9	2.7	3.3	3.0

mortality during adolescence and early maturity in the latter is not due to the small number of cases.

Comparison of the curves in Figure 2 shows that the mortality during the first year of life is highest among the Indians, but that whites and negroes do not differ to any large extent. In all three groups the proportion of deaths drops after the first year, reaching a low point in the age-intervals 5-14 years, but the races maintain their same relative positions of highest mortality among the Indians, and lowest among the whites, with negroes approximating the curve for whites.

In the age-interval 15-19 years, there is a striking difference between the three curves. The proportion of white deaths gradually increases in each subsequent age-interval, the slope of the curve remaining slight until about the age of 55, when its gradient increases sharply to a peak

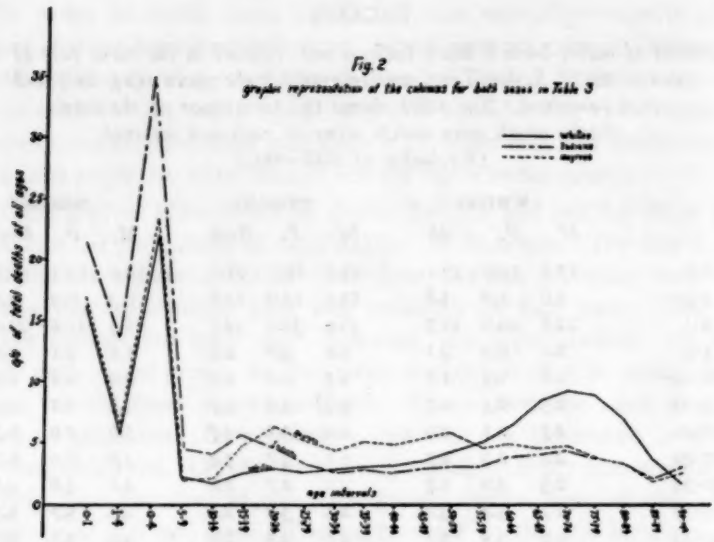

FIG. 2. PERCENTAGE AGE DISTRIBUTION OF DEATHS OF NATIVE-BORN WHITES, INDIANS, AND NEGROES IN THE RURAL PART OF THE U. S. REGISTRATION AREA.

at the ages of 70-74 years, after which the proportion of deaths per interval decreases rapidly. Among both Indians and negroes, however, the increase in the proportion of deaths per age-interval after childhood is much faster than among whites, so that their curves rise sharply in the interval 15-19 years, that for Indians reaching a peak at this age, while that for negroes touches a high point in the 20-24 year interval. From these respective peaks both curves descend until the age-step 30-34 years. The proportion of Indian deaths then remains fairly constant through the subsequent intervals until about the age of 60, when it rises gradually to 70-74 years and then descends. The ratio of negro deaths rises gradually from the 30-34 year interval to a peak at about 55 years and then slowly declines.

The proportion of total deaths per age interval for the Mohave and Chemehuevi Indians in Figure 1 follows the same general distribution as that for Indians in Figure 2, except that the increase in the period from 40-60 years is more rapid.

Aside from the difference in mortality during the first five years of life, the outstanding feature of these curves is the relatively great proportion of negro and Indian deaths occurring in late adolescence and

early maturity, followed by a decrease and a gradual rise again to a second peak in the later age-intervals. The higher apex of the curve for whites in these later intervals is due to the fact that proportionately fewer whites have died in the earlier periods. This latter point is illustrated by standard life tables which show that among whites an original generation is usually reduced by one-half between the ages of 55-70, and among the negroes between the ages of 25-40 years.

The distribution of white deaths has two peaks where a relatively great proportion of the total deaths occur; one during infancy and the other at old age. On the other hand, the distribution of Indian and negro deaths has three peaks; infancy, the period of late adolescence and early maturity, and old age.

The shape of these curves for whites and negroes is substantiated by the United States Life Tables which give the number of deaths at each age-interval out of one hundred thousand born alive in the original registration states.[4]

INFANT MORTALITY IN TABLES I AND 3

In Table 3 the proportion of total white male deaths occurring in the first year of life is 17.2 per cent, as opposed to 14.9 per cent for females, a difference of 2.3 per cent. For Indians the corresponding male and female figures are 23.4 per cent and 18.7 per cent respectively, the male excess amounting to 4.7 per cent. The negro ratios for the first year of life are 18.0 per cent for males and 15.3 per cent for females, with a male surplus of 2.7 per cent. In all three racial groups the larger proportion of the total deaths per sex which occurs in infancy, is male, with the greatest sexual difference among the Indians.

In the age-interval 1-4 years the mortality is lowest among the whites and slightly higher among negroes, but the Indian percentage is over twice that of the negroes and two and one-half times that of the whites. The sex differences in mortality in this age-interval are negligible in each group.

Among the Mohave and Chemehuevi Indians the sex ratio in infant mortality is the reverse of that among the Indians of Table 3, for here the proportion of male deaths occurring the first year of life is 20.1 per cent and the ratio of total female deaths is 22.6 per cent, a female

[4] Glover, (J. W.)—United States Life Tables. Bureau of the Census publication, Wash., 1921, pp. 264-268.

excess of 2.5 per cent. This difference, however, is practically offset in the next four years where 10.1 per cent of the total male deaths occur as opposed to 7.7 per cent of the total female deaths.

In the first five years of life the proportion of total white male deaths is 22.8 per cent and that of white female deaths is 20.6 per cent, an excess of 2.2 per cent of males over females. The corresponding figures for Indians are 36.9 per cent for males and 32.6 per cent for females, with a male balance of 4.3 per cent. Among the negroes 24.3 per cent of the male deaths occur in the first five years and 21.5 per cent of the female deaths, the male overplus amounting to 2.8 per cent. In Table 1 the male percentage for this age-interval is 30.2 per cent, compared with 30.3 per cent for females. This discrepancy with the distribution of Indian deaths in Table 3 may be due to the smaller number of instances here. Both tables agree, however, in showing not only a much higher infant mortality among Indians than among either whites or negroes, but also a higher mortality in the ages one to four years. It may well be that the Indian infant mortality is considerably higher than these figures indicate, for the registration of infant deaths on the reservations is admittedly incomplete. This point will be taken up again.

SEX DIFFERENCES IN DEATHS ABOVE THE AGE OF FIVE YEARS

Whites. According to Table 3 and Figure 3 the ratio of total deaths per age-interval is approximately the same for both sexes in the period

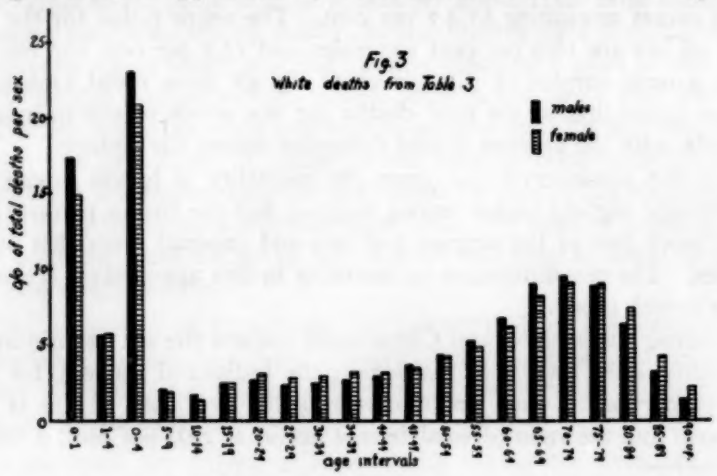

FIG. 3. PERCENTAGE AGE DISTRIBUTION OF DEATHS OF NATIVE-BORN WHITES IN THE RURAL PART OF THE U. S. REGISTRATION AREA, BY SEX.

5-19 years, with perhaps a slight balance of male deaths over female. In the next age-intervals, however, there is a consistent surplus of female over male deaths in every step from 20 to 44 years, this excess amounting to 2.1 per cent for the total period. Male deaths per age-interval exceed those of females from 45 to 74 years by 2.5 per cent. After the age of 75 years female deaths are 3.0 per cent greater than those of males.

Negroes. Aside from the infant mortality the sex differences appear five years earlier than among the whites. As shown by Table 3 and Figure 4, in the ages 5 to 14 years there is a slight but consistant surplus of female over male deaths. This difference becomes more pronounced

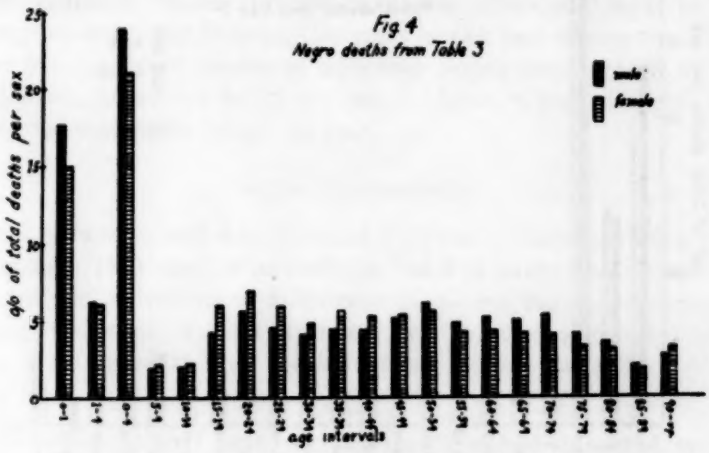

FIG. 4. PERCENTAGE AGE DISTRIBUTION OF NEGRO DEATHS IN THE RURAL PART OF THE U. S. REGISTRATION AREA, BY SEX.

in the ages from 15 to 49 years, the excess of female over male deaths being 7.6 per cent. If only the ages 20 to 44 years are counted the balance of negro female over male deaths amounts to 5.6 per cent, or over two and one-half times that for whites in the same age range. The greater female negro mortality at these ages is probably due in part at least to the higher death rate from puerperal causes among negroes. Male deaths per age-interval are consistently higher than those of females between 50 and 89 years, the difference amounting to 5.8 per cent. Above 90 years female deaths again exceed those of males.

Indians. According to Table 3 and Figure 5 the ratios of total deaths per age-interval are about the same for each sex from 5 to 14

years, with a slight surplus of male deaths. As with the negroes, the sex differences become pronounced five years earlier than among the whites. From 15 to 39 years there is a consistent excess of female over male deaths, the difference being 2.8 per cent. If only the ages from 20 to 39 years are considered, this excess is 2.2 per cent, as com-

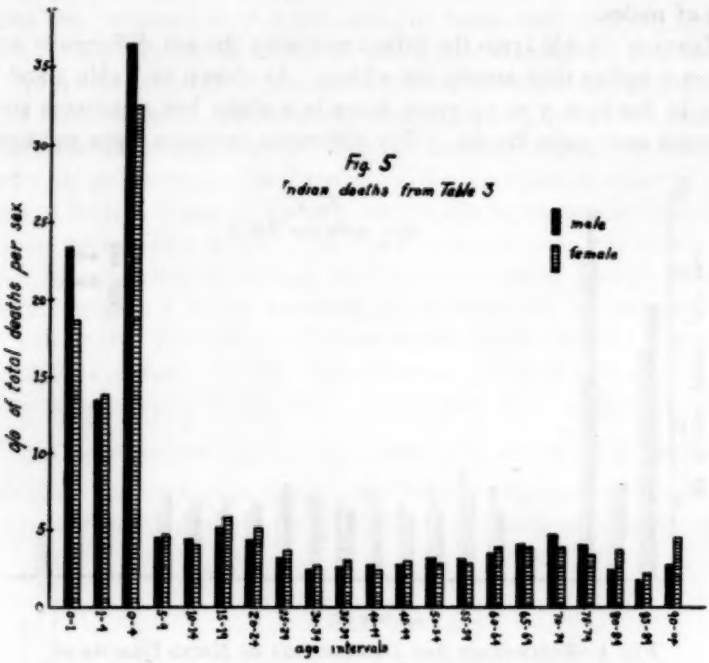

FIG. 5. PERCENTAGE AGE DISTRIBUTION OF INDIAN DEATHS IN THE RURAL PART OF THE U. S. REGISTRATION AREA, BY SEX.

pared with a female surplus of 1.8 per cent for whites and 4.7 per cent for negroes in the same period. As this is the child-bearing age it seems safe to assume that a fair proportion of the excess of female over male deaths is due to puerperal causes. If this is true it is rather surprising to find the rate so much lower among Indians than among negroes. If the negroes had a higher birth rate they might be expected to have a greater maternal mortality, but the Census Bureau figures give a slightly larger birth rate to Indians than to negroes. In the range from 40 to 79 years there is generally a surplus of male over female Indian deaths, the excess for the total period being 1.8 per cent, but this differ-

ence is not so consistent as with the whites and negroes. Above 80 years female deaths over-reach those of males by 3.7 per cent.

The distribution of deaths for the Mohave and Chemehuevi Indians in Table 1 and Figure 1 differs somewhat from that of the Indians in Table 3. In the age-intervals 5 to 14 years the ratio of female deaths exceeds that of males by 0.7 per cent. This is the reverse of the sex distribution of Indian deaths for these ages in Table 3, but it will be recalled that the same is true of the infant mortality in this group. In the ages from 15 to 39 years there is an excess of female over male deaths amounting to 3.2 per cent, but this is not consistent as male death ratios are higher than those of females in certain intervals within this period, although the sex differences become pronounced here, as with the negroes and other Indians, five years earlier than among the whites. There is a consistent surplus of male over female deaths in the ages 45 to 74 years, amounting to 8.7 per cent. Above 75 years female deaths exceed those of males by 4.2 per cent.

RACIAL DIFFERENCES

It is not maintained that the racial differences discussed in this paper are innate. They may be partially so, but it is likely that they are for the most part reflections of differences in culture, that is, differences in housing, sanitation, medical treatment and economic and social conditions. This, however, does not make them any the less real.

TABLE 4

Number per age level out of every 1,000 deaths of both sexes at all ages. (Modified from Tables 1 and 3.)

PHYSIOLOGICAL STATE	AGE INTERVALS	MOHAVE AND CHEMEHUEVI INDIANS	INDIANS FROM TABLE 3	NEGROES	WHITES
Infancy	0-1	213	211	167	161
Childhood	1-9	119	182	83	77
Adolescence and early youth	10-19	100	99	70	42
Reproductive period	20-39	178	136	211	113
Middle age	40-59	158	116	206	159
Old age	60-79	181	163	181	327
Senility	80 up	51	93	82	121
From birth through early youth		432	492	320	280
From birth through reproductive period		610	628	531	393
From birth through old age		949	907	918	879

Table 4 is a comparative list of the proportion of total deaths at all ages that occurs in wide age-intervals which may be taken as roughly corresponding to the physiological stages of infancy, childhood, adolescence and early youth, reproductive period, middle age, old age, and senility. The table is really a summarization of Tables 1 and 3, but its compactness enables certain facts to be brought out more clearly.

The high infant mortality among Indians as compared with whites and negroes has already been discussed, that for Indians being about 45 per thousand total deaths at all ages greater than among negroes, and about 50 per thousand higher than for whites. There is reason to suppose, however, that the Indian infant mortality is really higher than the above figures indicate, because of incomplete registration. In 1924, according to the Census Bureau figures, the infant mortality in the birth registration area was 63.2 infant deaths under one year per thousand live births for white infants whose mothers were native born. This rate was 114.1 for negroes, and 190.7 for Indians.[5] However, recent careful work by Dr. Sophie deAberle of the Yale Medical School, has shown an infant mortality of 231 per 1000 live births among Pueblo Indians. Part of the difference in infant mortality between whites and Indians is due to the higher birth rate among the Indians, but this is offset by the fact that a greater proportion of the Indian children born die within the first year of life.

During childhood these differences between the three groups retain their same relations but increase sharply, the mortality of Indians in the registration area for this period being 99 per thousand greater than that for negroes and 105 per thousand higher than among whites. This increase does not hold between the Mohave-Chemehuevi group and the whites and negroes, although the same relative differences remain. The low childhood mortality among the Chemehuevi and Mohave as compared with the Indians of the whole registration area may be due to the fact that children are better cared for in this particular group.

Through the period of adolescence and early youth the number of deaths per thousand is approximately the same for both sets of Indian data, but greater than for either negroes or whites, the negroes, however, having a considerably greater mortality at these ages than the whites. These differences are part of the curious rise in mortality

[5] U. S. Bureau of the Census. Birth Statistics for 1924, Tenth Annual Report. Wash., 1926, 38-39.

during this stage of life which seems to be characteristic of negroes and Indians as compared to whites, and has already been discussed.

Considering the span of life from birth through early youth, it will be seen that out of each thousand deaths of all ages, 492 have already occurred by the end of this period among Indians of the registration area. In the same division of the life span, 320 out of every thousand negro deaths have already taken place, and only 280 out of each thousand white deaths. In other words, by the beginning of the reproductive period, if that period is taken as starting at about the age of twenty years, there have already occurred 212 more deaths per thousand deaths at all ages among Indians than among whites, and 172 more per thousand than among negroes.

The fact that nearly one-half of the total number of Indian deaths taking place at all ages has already occurred by the commencement of the reproductive period throws considerable light on the present decline of the Indian population, but this point must be further analyzed because of its bearing on racial destiny. The survival rate of females is especially important in this connection. According to the data of Table 3, out of every 100 female deaths at all ages, 47 have taken place before the age of twenty years among Indians, 26.6 among whites, and 31.9 among negroes. The female survival rate up to the age of twenty years is thus about 53 per cent for Indians, 73 per cent for whites, and 68 per cent for negroes. These survival rates up to the age of forty years are 38 per cent, 61 per cent, and 45 per cent respectively for the three groups.

It is obvious that each Indian woman who survives through her reproductive period will have to produce more children on the average than will white or negro women, in order to maintain the population.

In 1924 the birth rate in the birth registration area was 28.4 per 1000 estimated population for Indians, 22.2 for whites, and 26.9 for negroes. These figures do show a somewhat higher birth rate for Indians, but in the same year births exceeded deaths by only 1.1 per cent among Indians, while this excess was 96.4 per cent and 49.4 per cent among whites and negroes, in spite of their lower birth rate.[6]

There is reason to believe that the actual Indian birth rate is higher than the government figures indicate. Due to the high infant mortality a relatively large proportion of infants die shortly after birth and are

[6] *Ibid.*, pp. 10-11.

not recorded. Dr. Sophie de Aberle's careful work, mentioned above, showed that among Pueblo Indian women the birth interval was approximately two years and the average number of children produced by women who had survived through the reproductive period was about nine, although the number of living children per family averaged less than one third of this number.

The Indian birth rate thus appears to be relatively high but is offset by the inordinately great mortality. As there is no reason to suppose that this birth rate will increase, it seems justifiable to conclude that the Indian population can be strengthened only by reducing the death rate, particularly in the ages under twenty years, in order that more individuals may live long enough to reproduce themselves effectively.

The most noticeable mortality difference during the reproductive span is that between negroes and both whites and Indians, the negro ratio being considerably greater than that for Indians and still higher than for the white rate. Through middle age the mortality among negroes likewise remains highest, but the positions of whites and Indians are reversed, the former having the higher death rate. During the period of old age the proportion of deaths per thousand total deaths is about the same for both Indians and negroes, but nearly twice as great among the whites. This is due to the fact that a smaller proportion of white deaths have taken place during the earlier stages of life.

Above eighty years the proportion of white deaths to the total deaths at all ages is considerably larger than that for either Indians or negroes, and serves again to illustrate the fact that more whites have survived to these ages. In view of the popular conception regarding the extreme longevity of Indians it is interesting to note not only the greater length of life among whites, but also the difference between the Mohave-Chemehuevi Indians and those of the registration area. In the latter group, 93 per thousand total deaths take place above the age of eighty years, while in the former this proportion is only 51 per thousand. Anyone who has had experience on the reservations will be familiar with the unreliability of the age records for very old Indians because, in the absence of definite information, there is a general tendency to ascribe ages to them which are in excess of the truth. As stated in the beginning of this paper, the ages of the Mohave-Chemehuevi group are more accurately known than is usual with Indians, and it seems likely that in the ages over eighty years the mortality figure for this group is more nearly the truth than that for the Indians of the

whole registration area. While this accuracy is not as great as among the whites, any error is likely to be in the direction of giving ages older than actuality on account of the tendency noted above.

It would thus appear that the common notion of the extreme longevity of Indians as a race is largely a myth and that actually both negroes and whites, especially the latter, are longer lived. This conclusion is further strengthened when it is considered that the conditions under which the Indian lives militate against his reaching any advanced age.

CAUSES OF DEATH

The racial and sex differences in mortality which have been demonstrated in the foregoing section will be more thoroughly understood by a corresponding inquiry into the causes of death. Table 5 is based on Census Bureau mortality reports and lists the number of deaths per thousand total deaths at all ages occurring from main causes among whites, negroes and Indians of the registration area for the years 1924 and 1926 combined.[1] The Mohave and Chemehuevi data collected by the writer are also given here.

Comparative statistics of this kind need to be taken cautiously, for the interpretation of the differences is not simple. For example, the negro and Indian death rate from cancer appears to be very much less than that of whites. This may be due, however, either to an actual racial difference or may merely reflect a greater degree of diagnostic accuracy in the case of whites, although there seems some agreement among medical men that the negro incidence of the disease is low. In any event, the comparative differences are significant and in many cases are so large and of such nature as to leave little doubt of the actual greater or lesser prevalence of certain diseases in the different racial groups.

The mortality from influenza among all three groups of the registration area was approximately twice as great in 1926 as in 1924, but the sex and race differences to be noted were relatively the same in both years. Deaths from ill-defined diseases and unknown and external causes have been omitted from the tabulation in order to make the racial mortalities from specific diseases more comparable. In the Mohave-

[1] Mortality Statistics. Bureau of the Census, *Op. cit.*, 1926, pp. 110-136; 1924, pp. 196-222.

TABLE 5

Number of deaths per thousand total deaths at all ages by sex. (Exclusive of those due to ill-defined diseases, unknown and external causes, and stillbirths)

CAUSES OF DEATH	WHITES		NEGROES		INDIANS OF CHEMEHUEVI AND MOHAVE			
					REGISTRATION AREA		INDIANS	
	M.	*F.*	*M.*	*F.*	*M.*	*F.*	*M.*	*F.*
Influenza	27	26	37	36	49	47	30	27
Tuberculosis of respiratory system	65	61	120	132	239	256	351	333
Tuberculosis other than of respiratory system	9	9	17	15	46	41	89	27
Tuberculosis (all forms)	74	70	137	147	285	297	440	360
Syphilis	7	3	30	19	10	7	7	40
Cancer and other malignant tumors	81	109	24	51	15	32	29	33
Diabetes mellitus	13	21	6	9	3	6	7	0
Cerebral hemorrhage	80	85	54	63	27	21	15	21
Diseases of the heart	186	178	139	131	67	66	45	47
Pneumonia (all forms)	95	82	134	97	159	145	143	120
Diarrhea and enteritis (under 2 yrs.)	26	21	35	28	44	38	60	66
Chronic nephritis (over 10 yrs.)	82	81	88	73	33	26	22	13
Other non-venereal diseases of the genito-urinary system and annexa	16	17	24	29	15	12	0	0
The puerperal state	..	26	..	40	..	36	..	20
Malformations	15	12	5	4	9	7	0	13
Early infancy	62	50	60	47	64	40	90	100
Senility	9	12	15	18	26	45	30	80
All other causes except still-births, ill-defined diseases and unknown and external causes	227	207	212	208	194	175	82	60

Chemehuevi group, 15.7 per cent of the total deaths were due to ill-defined, external and unknown causes, and in the registration area the corresponding figures are 15.6 per cent, 13.1 per cent, and 9.1 per cent respectively for Indians, negroes and whites. The relatively low figure for whites may be due to better diagnoses.

Exclusive of these deaths, the causes listed in Table 5 account for 78.3 per cent of the white deaths, 79 per cent of the negroes, 81.5 per cent of the registration Indians, and 92.9 per cent of the Mohave-

Chemehuevi. The remainder of the deaths were due to various causes, no one of which was responsible for any large proportion, although it should be mentioned that appendicitis and typhlitis caused a larger percentage of deaths among whites than among either Indians or negroes, while pellegra was responsible for a higher ratio of deaths among negroes than among whites or Indians.

Sex and Race Differences

Inspection of Table 5 will show that the most striking racial differences are in those deaths from pulmonary diseases. Among both Indians and negroes the number of deaths due to influenza per thousand total deaths is greater for both sexes than among whites and this difference increases greatly in the case of tuberculosis. The proportion of negro deaths from pulmonary tuberculosis is approximately twice as great as that for whites, and the Indian death rate from this cause is over four times the white rate. The same relative differences between the races hold also for other forms of tuberculosis. In the case of deaths due to any or all forms of the disease, white females show a slightly lower death rate than the males, but these relations are reversed among the negroes and Indians of the registration area. The Mohave-Chemehuevi data, however, show a male death rate from all forms of tuberculosis considerably greater than that of females.

Both groups of Indians show a higher mortality from pneumonia than either whites or negroes, the whites having the lowest death rate from this cause. In all four groups the female death rate from pneumonia is somewhat lower than that for males.

In the case of syphilis, the negroes show a far higher mortality than either whites or Indians, the negro rate being about five times that for whites, and three times the Indian rate. The disease is responsible for approximately twice as great a proportion of male deaths as female, except among the Indians, where this difference becomes smaller. The high proportion of deaths from this cause in the Mohave-Chemehuevi group is a special case, for syphilis is extremely prevalent among these Indians. The great excess of female over male deaths from this cause here is rather odd, but may be due to a greater proportion of syphilitic males dying from other causes. In any event it is interesting to note that in the registration area as a whole the Indian death rate from syphilis is not a great deal more than that for whites, while the negro rate indicates a very much higher incidence of the disease.

Most of the deaths from malformation occur in infancy and the sex differences are probably not significant, although there is a slight and consistent excess of male over female deaths, except among the Mohave-Chemehuevi, where the discrepancy is probably due to the small number of cases. The lowest death rate occurs among the negroes and the highest among the whites, with the Indian rate occupying an intermediate position.

Diabetes causes a greater proportion of white deaths than it does among either Indians or negroes, and the same is true of cerebral hemorrhage.

The mortality from cancer among whites is about three and one-half times the Indian death rate from this cause, and over twice the negro rate. In each group the female mortality from cancer is considerably higher than that for males. The death rate for heart disease, likewise, is highest among whites and lowest among Indians, with the negro rate intermediate. As cerebral hemorrhage, cancer and heart disease are distinctly afflictions characteristic of old age, the higher white mortality from these causes is doubtless due in part to the fact previously discussed, that a greater proportion of whites live into advanced ages.

The death rate from nephritis and other non-venereal diseases of the genito-urinary system is highest among negroes, although the mortality among whites is nearly as large. The Indian rate from these causes is less than half of the other two races. Among whites the proportions of male and female deaths from these diseases are about the same, but in the other groups the male rate is in excess of the female.

The mortality among females from puerperal causes is nearly twice as great among negroes as among whites and the Indian rate in the registration area is almost as high.[8] This difference is to be expected on account of the better pre-natal and post-natal care of white mothers. The Mohave-Chemehuevi statistics show a comparatively low mortality from puerperal causes, a fact of particular interest in view of the high death rate from syphilis and tuberculosis among females of this group.

As would be expected from the relative infant mortality in the three races, the death rate from diarrhea and enteritis under two years is

[8] The higher death rate from puerperal causes among negroes is probably correlated with their higher incidence of syphilis. Solomon, (H. C.) and (M. H.)—Syphilis of the Innocent. Wash., 1922, p. 128.

highest among the Indians and lowest among whites, with the negro rate intermediate. The proportion of deaths from other causes peculiar to early infancy is likewise greatest among Indians, but about the same for whites and negroes. In the matter of sex differences the Mohave-Chemehuevi data present a curious variation, for the mortality from enteritis and other diseases of infancy is considerably greater here among females than among males, although the opposite is true in the other groups.

The death rate from senility is lowest among whites and about four times as high among Indians, with the negro rate somewhat greater than that for whites. This is rather curious, in view of the conclusion previously reached in regard to the greater longevity of whites. It is probably to be explained by the fact that, generally speaking, medical diagnoses are better among whites than either negroes or Indians. Consequently, a larger proportion of negro and Indian deaths in old age are ascribed vaguely to senility, while white deaths at these ages are usually referred to more specific causes. That some such explanation must be true is obvious from the actual fact that a greater proportion of white deaths do occur at advanced ages.

As a convenience the main causes of death are listed below in their order of importance for each group.

Whites.	*Negroes.*
Heart disease.	Tuberculosis.
Kidney disease.	Heart disease.
Cancer.	Pneumonia.
Pneumonia.	Kidney disease.
Tuberculosis.	Cerebral hemorrhage.
Cerebral hemorrhage.	Causes peculiar to early infancy.
Causes peculiar to early infancy.	Influenza.
Indians.	*Mohave-Chemehuevi.*
Tuberculosis.	Tuberculosis.
Pneumonia.	Pneumonia.
Heart disease.	Causes peculiar to early infancy.
Causes peculiar to early infancy.	Diarrhea and enteritis.
Kidney disease.	Senility.
Influenza.	Heart disease.
Diarrhea and enteritis.	Cancer.

Deaths at ages before the beginning of the reproductive period

The age distribution of deaths from various causes is given in the Census Bureau mortality reports for whites and colored, but Indians,

negroes, and other races are not distinguished in the colored grouping. For this reason only whites have been used in the comparison to be made with the Mohave-Chemehuevi group in regard to the ages at which deaths from various causes occur. As the number of these Indian deaths is small, no detailed listing by age and cause is given. Among both whites and Indians, however, causes such as cancer, cerebral hemorrhage, kidney disease and heart disease operate chiefly at middle age and older, with the median ages slightly higher in each case for the whites.

In connection with what has been said concerning the relatively high mortality of Indians in the ages before the beginning of the reproductive period, it will be interesting to discuss more fully the causes of death which operate in these ages. (See Table 4.)

The number of deaths per thousand deaths under twenty years of age are listed by main causes in Table 6. The data for the whites have

TABLE 6

Number of deaths for each cause per thousand total deaths under 20 years. (Exclusive of deaths due to ill-defined diseases, stillbirths, and external and unknown causes.)

CAUSE OF DEATH	WHITES		MOHAVE-CHEMEHUEVI INDIANS	
	Male	*Female*	*Male*	*Female*
Influenza	35	33	34	59
Measles	31	32	0	0
Whooping cough	27	38	0	0
Diphtheria	33	36	0	0
Tuberculosis (pulmonary)	18	39	172	279
Tuberculosis (other than pulmonary)	18	19	155	44
Tuberculosis (all forms)	36	58	327	323
Pneumonia (all forms)	152	143	241	191
Diarrhea and enteritis (under 2 yrs.)	108	102	139	147
Malformations	62	59	0	29
Early infancy	264	234	207	221
Other causes exclusive of ill-defined diseases, external and unknown causes	252	265	52	30

been drawn from the Census Bureau mortality reports and the ratios given are for the years 1924 and 1926 combined.[9] Stillbirths as well as deaths due to ill-defined diseases and external and unknown causes have

[9] See footnote 5 for reference.

been omitted from the tabulation. Exclusive of stillbirths, this class of causes accounts for 118 per thousand total white male deaths under twenty years of age and 79 per thousand white female deaths. The corresponding figures for the Indians are 183 and 103 per thousand for males and females respectively.

Ignoring deaths from other diseases than those specifically named in the table, it will be seen that the largest proportion of white deaths under twenty years is due to causes peculiar to early infancy. Pneumonia is the next most potent cause of death for both sexes, and the third largest proportion is deaths occurring under two years of age and due to enteritis and diarrhea. Malformation is fourth in importance, while the proportions of deaths due to other causes are about the same for each cause. It is especially interesting to note that tuberculosis (all forms) is not responsible for a much greater proportion of white deaths under twenty years than are such diseases as diphtheria, whooping cough, measles and influenza.

Among Indians, tuberculosis is responsible for by far the greatest proportion of deaths under twenty years. In this connection it should be said that while none of the Indian deaths are recorded as due to measles, this latter disease was prevalent among them and in children very often had a sequel of pulmonary tuberculosis. The second most important cause of Indian deaths under twenty years is pneumonia, and the third largest proportion occurs in early infancy from causes peculiar to that age. The only other important causes of death are diarrhea and enteritis, operating in the first two years of life.

It is obvious from this that the greater part of the high Indian mortality under twenty years of age is due to tuberculosis and pneumonia. Furthermore, as the proportion of white deaths due to diarrhea, enteritis, and causes peculiar to early infancy is only very slightly lower than the ratio for the same class of causes among Indians, it is to be concluded that much of the higher infant mortality among Indians is due to pneumonia and the various forms of tuberculosis.[10]

These facts bear significantly on the point already discussed, that nearly one-half of the total number of Indian deaths taking place at

[10] Supporting facts are contained in the studies by Hoffman and Bushnell.

Hoffman, (F. L.)—The Health Progress of the North American Indian. Paper read before the Third Race Betterment Conference, Battle Creek, Mich., Jan., 1928 and published by the Prudential Press.

Bushnell, (G. E.)—The Epidemiology of Tuberculosis. N. Y., 1922, p. 163.

all ages have already occurred by the beginning of the reproductive period. It was stated above that the Indian birth rate is very high, but that the population is held practically stationary because of the excessively large death rate. As most of the higher mortality under twenty years appears to be due to tuberculosis and pneumonia, it seems quite certain that it is these two diseases which are chiefly responsible for the precarious condition of the aboriginal population by causing a high proportion of deaths at ages too early for individuals adequately to reproduce themselves. That is to say, while it is true the survivors have a high birth rate, the number of such survivors is too small to do more than barely maintain the population, and this only by reason of relatively great fecundity.

No support can be given the idea that an increased pre-disposition, or increased resistance, to tuberculosis is inherited, and the notion of innate racial susceptibility to the disease is fallacious.[11] It thus appears that the reduction of the Indian mortality from tuberculosis, and probably also from pneumonia, is largely a matter of hygiene.

SUMMARY OF CONCLUSIONS

1. The age distribution of negro and Indian deaths has three peaks where a relatively great proportion of the total deaths occur: infancy, the period of late adolescence and early maturity, and old age. The distribution of white deaths has only two of these peaks, infancy and old age.

2. Infant mortality is much higher among Indians than either whites or negroes, and the infant death rate among negroes is higher than among whites. These relative differences in racial mortalities hold throughout the first five years of life. A greater proportion of male than female deaths occurs in this age interval.

3. Among whites a consistently larger proportion of female than male deaths takes place in the ages from 20 to 44 years. This sex difference begins five years earlier among both Indians and negroes, and the excess of female over male deaths is greater in the two latter races. It appears that the higher mortality of females during this period may be partly accounted for on the basis of puerperal causes.

4. The proportion of the total deaths at all ages which occurs at ages from birth to the beginning of the reproductive period is very

[11] Bushnell, (G. E.)—*Op. cit.*, p. 203.

much larger among Indians than among negroes or whites, although the negro death rate during this period is considerably higher than the white rate. This suggests that much of the decline of the aboriginal population is due to the fact that a high proportion of deaths occurs at ages too young for individuals to adequately reproduce themselves.

5. The proportion of females surviving into the reproductive period is greatest among whites and least among Indians. Although the Indian survivors have a much higher birth rate, their number is too small to do more than barely maintain the population, and this only by reason of relatively great fecundity.

6. The longevity of Indians appears to be much less than that of negroes or whites, the latter showing much the largest proportion of deaths at advanced ages.

7. In all three groups a greater proportion of female than male deaths occurs at very advanced ages, indicating that old women live longer than old men.

8. Among whites, heart diseases, kidney disease and cancer are more important causes of death than pulmonary diseases, while among negroes and Indians tuberculosis and pneumonia are the main causes.

9. The greater part of the high Indian death rate under 20 years of age is due to tuberculosis and pneumonia. These latter two diseases are also responsible for much of the difference in infant mortality between whites and Indians.

10. If the death rate from tuberculosis and pneumonia can be materially lowered among Indians, the most serious checks to the increase of the aboriginal population will have been removed.

THE USE OF INDICES AS AN AUXILIARY METHOD IN THE ESTABLISHMENT OF PHYSICAL TYPES*

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Following Kretschmer's revival of clinical constitutional biology, it soon became evident that the indices devised by anthropologists, mostly for racial purposes, were, for the most part, inapplicable to the differentiation of clinical physical types. Nevertheless, from the beginning, Kretschmer was able to apply Pignet's index for the mathematical differentiation of his schizophrenic and manic-depressive patients. Further, he made use of the relation of the chest-circumference to the shoulder-breadth to differentiate between pycnics and non-pycnics—a suitable ratio in view of the large chest-circumference contrasted with the small shoulder-breadth of the former. In our clinic we have made great use of this index, which is called the Chest-Shoulder index. In especial, Kretschmer and Enke (2 and 5) were able to employ it in the field of pure experimental psychology to represent certain psychophysical relationships mathematically.

Parallel with these investigations, some foreign investigators combined the Kretschmer correlates with certain *ad hoc* indices. Wertheimer (6), for instance, applied the relation of the leg-length to the trunk-capacity in a manner which will be discussed later; and Andreew (1) utilized the relation of the length of the extremities to trunk measurements according to a different method. We shall later deal with these two indices in greater detail. They have proved very useful to the authors concerned.

Obviously, no index-value, however ingeniously elaborated, can ever be regarded as even an approximate substitute for a précis embodying full measurements and descriptions of importance. For the pure empir-

* From the Universitäts-Nervenklinik Marburg/L. Direktor: Professor Dr. E. Kretschmer.

icist, an index, at the best, is only an abstraction of a part of the sum-total of all the biologically important facts. Nevertheless, in view of their conciseness, handiness and mathematical exactitude, the improved use of characteristic indices for appropriate investigations is a highly desirable object.

The present work is intended as a contribution to the mathematical treatment of problems concerned with physical constitution. Our material consisted of 439 pure physical types selected from 702 men, all of whom were fully measured and described. Our object was to determine the most characteristic indices for the arithmetical differentiation of physical types. Among a great number of calculated indices—see the works published by the present writer in collaboration with Hartner (7) and E. B. Strauss (8)—six proved to be especially suitable.

1. *Pignet's Index:*

Height — (Chest-circumference + Weight)*

which is therefore to be regarded as an index of body-capacity (*Körper-*

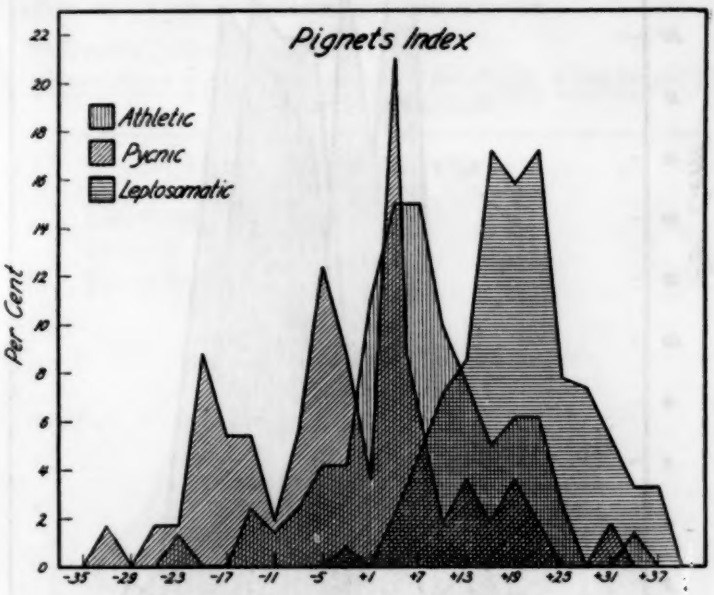

FIG. 1. PERCENTAGE DISTRIBUTION OF PIGNET'S INDEX IN DIFFERENT PHYSICAL TYPES

* Linear measurements are throughout calculated in centimetres, and weight in kilogrammes.

fülle). With this index (see Fig. 1) the values for pycnics lie between —36 and +25. This wide variation is explained (as in the case of the other physical types) by the fact that in this index a decisive rôle is played by the weight of the body, which in our mostly psychotic material is naturally subject to great variations. If we ignore the extreme cases (the very stout and the very thin), we can assume that the values for pycnics lie predominantly between —20 and +10. In the case of

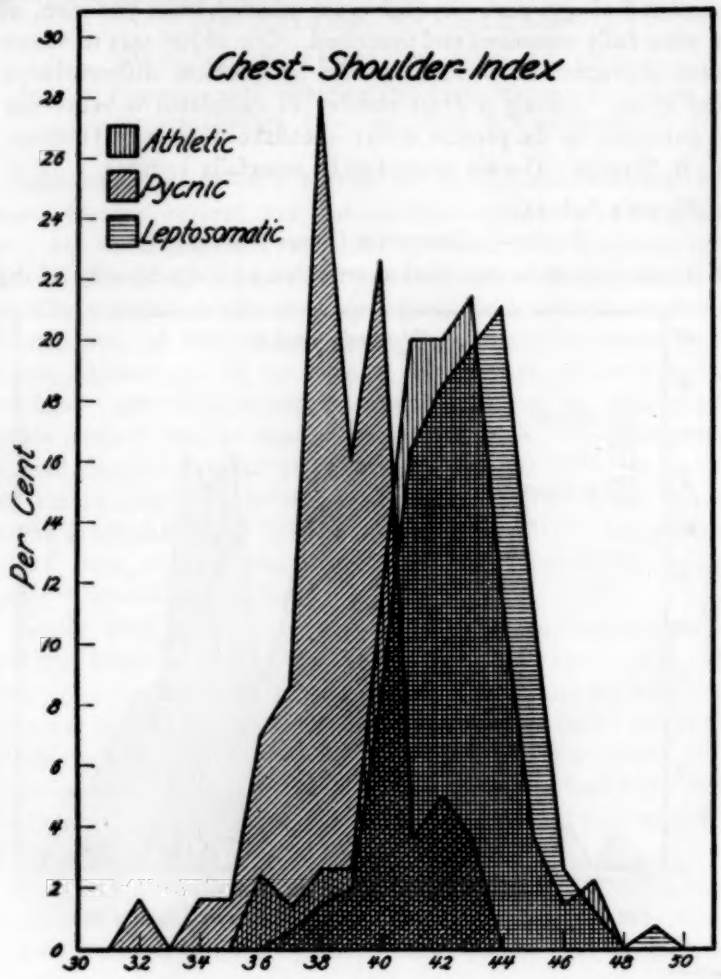

FIG. 2. PERCENTAGE DISTRIBUTION OF CHEST-SHOULDER INDEX IN DIFFERENT PHYSICAL TYPES

leptosomatics, the values lie mostly between + 10 and + 30. The index-values for athletics lie, in the main, between — 2 and + 22, so that the frequency-curve for athletics intersects those of the pycnics and leptosomatics. In this index, then, the pycnics and leptosomatics are fairly clearly differentiated, with only quite small intersections. On the other hand, the index seems to be less serviceable for the separation of athletics from the other two physical types.

2. *The Chest-Shoulder Index:*

$$\frac{\text{Shoulder-breadth} \times 100}{\text{Chest-circumference}}$$

The results are shown in graphic form in Fig. 2.

Here, too, the curves of the leptosomatics and the pycnics are quite clearly separated. The most frequent values for the pycnics lie between 40 and 46. The curves for the athletics and leptosomatics overlap almost completely. The index shows itself, therefore, to be very useful for the differentiation of pycnics and non-pycnics, but is of no value for the further separation of leptosomatics and athletics.

3. *Andreew's Index (Modified*):*

$$\frac{[(\text{Chest-circumference} + \text{Abdominal girth}) - (\text{Arm-length} + \text{Leg-length})] \times 100}{\text{Chest-breadth} \times \text{Chest-depth}}$$

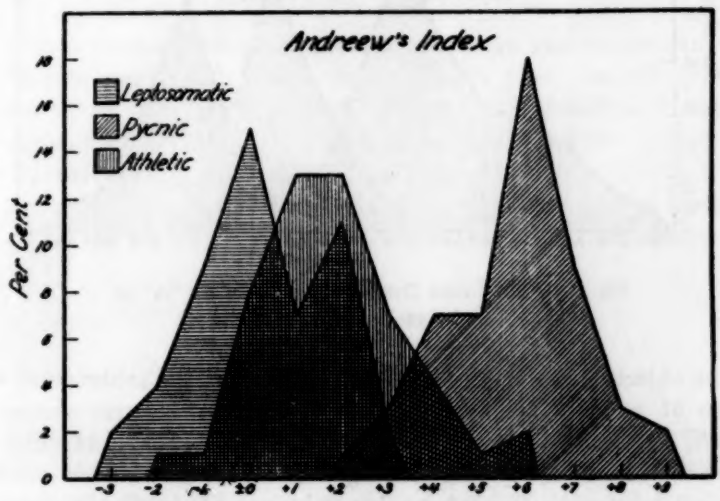

FIG. 3. PERCENTAGE DISTRIBUTION OF ANDREEW'S INDEX IN DIFFERENT PHYSICAL TYPES

* Andreew's index slightly modified by Strauss and Westphal. In Andreew's original index the body-height figures in the numerator.

This index, the object of which is to determine a relation between the trunk-capacity and the length of the limbs, gave us for our material (see Fig. 3) a particularly clear differentiation of the pycnic curve from the others. The athletic and leptosomatic curves, on the other hand, show a very considerable coincidence.

Whereas the three preceding indices all allow of the separation of pycnics from leptosomatics and athletics, in the choice of the three remaining indices we attached especial importance to the possible differentiation of the two latter types, since between these two types of physique intermediate forms are very common, the differential diagnosis of which is often a matter of great difficulty.

4. *Index "A."* (devised by Hartner and the present writer, and so-called by us for convenience):

$$\frac{\text{Height of head} \times \text{Hand-breadth} \times \text{Shoulder-breadth} \times \text{Chest-circumference}}{1000}$$

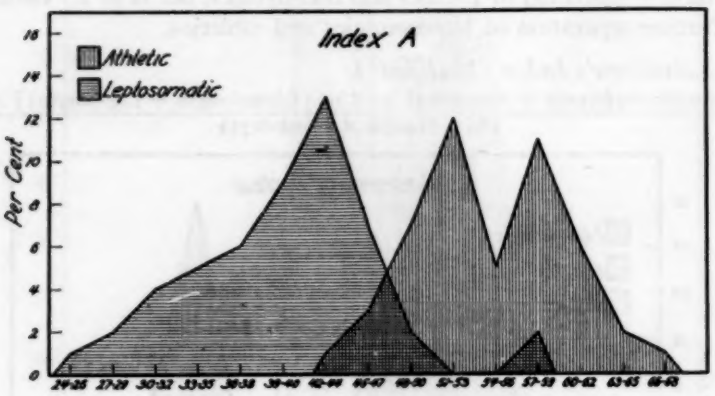

FIG. 4. PERCENTAGE DISTRIBUTION OF INDEX "A" IN DIFFERENT PHYSICAL TYPES

The object of this index is an attempt to effect the arithmetical separation of athletics and leptosomatics, which has hitherto proved so difficult, by massing together those measurements which according to experience are especially large amongst athletics. This index achieves its object quite well. The index-value 47 is the point of division between athletics and leptosomatics (see Fig. 4). In this figure, we have omitted the pycnic curve, which overlaps with the leptosomatic, in order not to obscure the essential features of the other two curves.

5. *Index "B"* (Strauss and Westphal):

$$\frac{\text{Height of body} \times 10{,}000}{\text{Chest-breadth} \times \text{Chest-depth} \times \text{Anterior trunk-length} \times \text{Shoulder-breadth}}$$

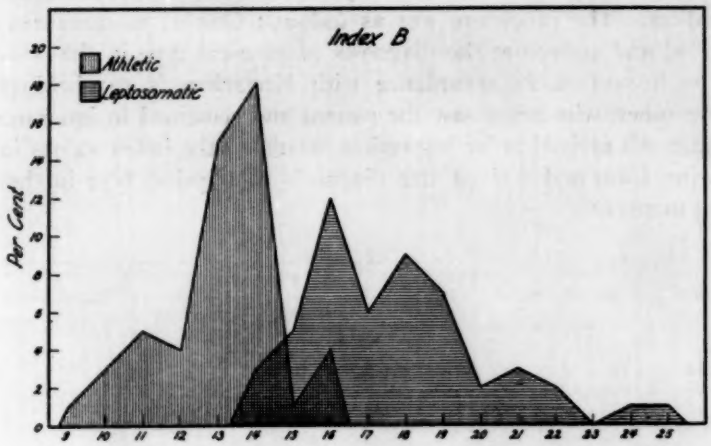

FIG. 5. PERCENTAGE DISTRIBUTION OF INDEX "B" IN DIFFERENT PHYSICAL TYPES

This is in essentials a modification by Strauss and the present writer of Wertheimer's well known index, which gives beautifully closed curves for all three physical types. But the differentiation provided by the unmodified Wertheimer index is insufficient for the present purposes; consequently, we included in the denominator a typically athletic factor, namely his breadth of shoulders, and thereby reduced the coincidence of the leptosomatic and athletic curves to a minimum. (See Fig. 5.)

6. *Index "C"* (Strauss and Westphal):

$$\frac{\text{Chest-breadth} \times \text{Chest-depth} \times \text{Shoulder-breadth}}{\text{Bisiliac crest-breadth} \times \text{Bitrochanteric breadth}}$$

In this index, Strauss and the present writer endeavored to introduce another of the chief physical characteristics peculiar to the athletic type of habitus, namely the trapezium-shaped narrowing of the trunk from the powerful shoulders and broad thorax down to the relatively slender hips. In this index also, the athletics are well differentiated from the leptosomatics. (See Fig. 6.)

A glance at all the curves shows that no one of these indices, taken singly, enables us to separate out all three Kretschmer types from one another. We therefore attempted to arrive at a diagnosis of physical type, without inspection, with the help of the combined application of all six indices. The procedure was as follows: One of us measured and described and arrived at the diagnosis of physical type in the ordinary way by inspection, in accordance with Kretschmer's psychobiogram; and the other, who never saw the patient and remained in ignorance of the diagnosis arrived at by inspection, tabulated the index values in the following form and arrived at a diagnosis of physical type in the following manner:

INDEX	INDEX-VALUE	PYCNIC	ATHLETIC		LEPTOSOMATIC
			Slender	*Stout*	
Chest-shoulder					
Pignet					
Andreew					
"A"					
"B"					
"C"					

When, in the particular case, the index-value came well within the set of values characterizing a particular physical type, we filled in the appropriate place with + + ; if it came into a set of values shared by 5 —10% of our test-cases, we marked the appropriate space + ; if the index-value corresponded with only 1-3 of our test-cases we marked it ±, and if the index-value was quite outside a particular physical group, we marked it with —. A minus sign in a column excluded the habitus in question. The other columns were evaluated according to the number of plus signs.

This procedure produced a surprising congruity between the two sets of diagnoses of physical type. Both methods yielded essentially the same results, so that both may be regarded within their limits as valid and

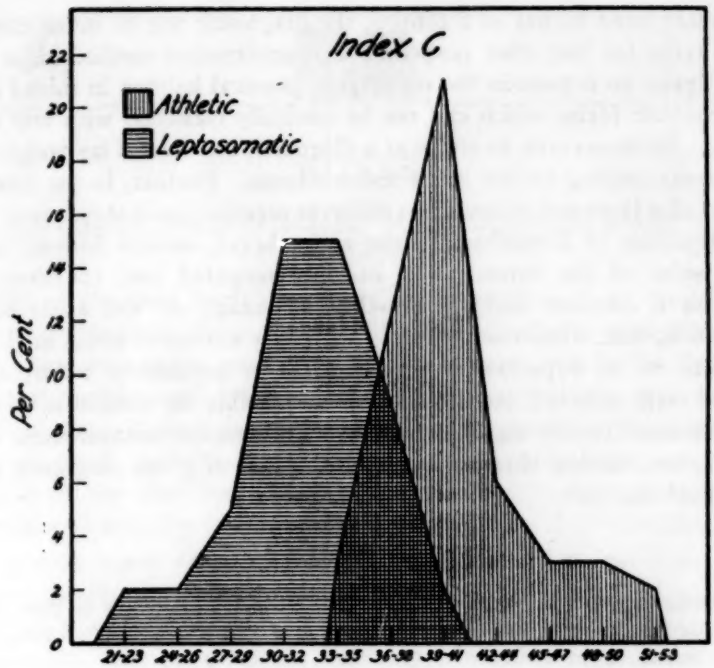

FIG. 6. PERCENTAGE DISTRIBUTION OF INDEX "C" IN DIFFERENT PHYSICAL TYPES

serviceable. It was also apparent that the ordinary diagnostic method based on simple measurements and somatoscopy, employed by a skilled observer, brings out the arithmetical essentials; and that, conversely, a diagnosis arithmetically based on combined indices can give in suitable cases what is, in essence, a summary of the general biological features.

We also regard as an important outcome of our results the possibility which it affords the clinical investigator of controlling his own diagnoses. A serious discrepancy between the diagnosis derived from indices and that obtained by simple measurements and somatoscopy should compel even the most skilled and experienced investigator to repeat his examination. Each method, then, can be used to support the other; although the arithmetical method alone is no guard against the investigator overlooking important dysplastic stigmata in the face, hair and fat distribution, etc. For this reason, if for no other, the control of the arithmetical method by means of the complete clinical method is as important as the converse process.

Apart from its use as a control, the diagnostic use of index curves is of value for two other purposes: The arithmetical method helps the investigator to determine the underlying physical habitus in mixed and intermediate forms which can not be clinically classified with any certainty. In these cases, to arrive at a diagnosis, one should lay weight on the predominating factors in the index-schema. Further, in the investigation of a large series from two different aspects (as in the case of the investigations of Kretschmer, Enke and others), indices derived from both sides of the investigation can be compared and combined to produce a common factor. Another advantage of the arithmetical method is, that, when one is dealing with very extensive series in investigations of an experimental-psychological or psychiatric nature concerned with physical constitution, it is possible to substitute partial measurement (easily made in practice) for complete measurement and description, without thereby incurring the risk of gross diagnostic and statistical blunders.

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NOTES

CHURCH MEMBERSHIP AND COMMITMENTS OF PRISONERS*

One of the chief traditional functions of religion, as of the law, is to keep people from doing wrong. The fear of hell fire is supposed to deter those who might not be kept in the narrow path by the fear of temporal punishments. Nor is fear the only instrument in the armory of the church. It aims also to instill the love of good into the young, to build character, as the phrase goes. Many people who do not accept the dogmas of the churches nevertheless consider that their function of guardians of morality is a sufficient justification for their existence.

As with many other of our common assumptions, we have been content for the most part to leave this as an assumption. There have been few attempts to measure the efficiency of the churches as guardians of morality. Bonger gives the following criminality rates, based upon the criminal statistics of more than 126,000 individuals sentenced during the period from 1901 to 1909 in the Netherlands.

Bonger sums up his table as follows: "The first place is almost always occupied by the Catholics, the second by the Protestants, and then come the Jews (except in cases of receiving stolen goods, embezzlement, and fraud), and the minimum of criminality (in all crimes without exception) is shown by the irreligious." And Parmalee's comment is

> It is not surprising that there is a lower percentage of criminality among those who are accounted as irreligious, for this group includes a larger percentage than the religious group of persons who think for themselves and who, whether religious or irreligious, do not accept the authority and tutelage of any religious organization. This fact implies a high standard of intelligence and education, which is not usually correlated with criminality. This is not because intelligence and education are in themselves necessarily preventives of crime, but because they are likely to place an individual in a position in society where the temptations towards criminal conduct are comparatively small.

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* From the Department of Biology of the School of Hygiene and Public Health of the Johns Hopkins University.

TABLE 1

Religion and Crime in the Netherlands, 1901-1909

Number Sentenced to 100,000 of the Population over 10 Years Old

	PROTESTANT	CATHOLIC	JEW	NOT MEMBERS OF ANY RELIGION	TOTAL POPULATION
All offenses	308.6	*416.5*	212.7	84.2	337.3
Theft	40.0	*54.8*	25.5	9.6	43.9
Aggravated theft	19.9	*24.0*	12.7	5.2	20.7
Receiving stolen goods	2.6	3.5	*9.2*	0.7	3.0
Embezzlement	8.6	9.3	*13.1*	1.9	8.7
Fraud	2.4	2.5	*3.9*	0.4	2.4
Offenses against public decency	1.9	*3.4*	2.0	0.5	2.4
Minor sexual offenses	*1.2*	1.0	0.3	0.2	1.0
Rape	1.5	*2.2*	1.5	0.7	1.8
Sexual crimes with persons under 16	*0.3*	*0.3*	0.1	0.0	0.3
All sexual crimes	5.1	*7.1*	4.1	1.6	5.7
Rebellion	25.9	*37.0*	13.2	12.2	29.0
Assaults	74.4	*98.2*	43.2	20.1	80.1
Serious assaults	8.5	*11.0*	3.9	1.9	9.1
Homicide and murder	0.4	*0.6*	0.5	0.1	0.5

There is, however, a possible statistical fallacy involved in taking these rates at their face value. There are obvious advantages to a prisoner in claiming membership in some church, and this will tend to increase the recorded criminality rates of church-members as compared with non-church-members. The old rhyme assures us that

> When the Devil was ill,
> The Devil a monk would be,

and it is not unlikely that when the Devil was in prison he edified the Chaplain by a similar display of piety.

What evidence have we for the United States? Murchison in his careful study of the intelligence of criminals writes:

> Most criminals belong to some church, and frankly admit the fact. The big majority attend the church services every Sunday morning in the prison chapel. Of the men in the Maryland Penitentiary, 43.5 per cent belong to some Protestant church, 34.4 per cent belong to some Catholic church, 7.8 per cent are Hebrews, while 14.3 per cent are frankly agnostic.

The corresponding percentages for the population of Maryland in 1926 are: Protestant, 28.6 per cent; Catholic (including Eastern Orthodox) 15.0 per cent; Hebrew, 4.4 per cent; leaving 52.0 per cent who do not belong to any religious body. But these percentages include chil-

dren, who are not exposed to the risk of being sentenced to the penitentiary. Perhaps it would be fairer to exclude them. The Census Bureau attempted to obtain data on church membership by age, but these are unfortunately wholly lacking for the Jewish Congregations and incomplete for many other denominations. Estimating the total membership by age on the basis of the distribution by age of those reported, we find that 33.4 per cent of the population of Maryland 13 years of age and over were Protestant, and 14.7 per cent were Catholic. In other words, in Maryland as in the Netherlands, the figures indicate that there is a larger proportion of church members in the penitentiary than in the general population.

Dunn found for the United States that of 25,726 persons imprisoned in twenty-seven state penitentiaries, 23.4 per cent were Roman Catholics and 53.9 per cent Protestants, making a total of 77.3 per cent, while "the remaining 22.7 per cent was made up of Jews, Mormons and others; also of a few foreign cults and of many who professed no religion." Of 7,108 in nineteen reform schools, industrial schools and the like, 18.9 per cent were Roman Catholics and 33 per cent were Protestants, making a total of 51.9 per cent. For the two groups added together, 22.5 per cent were Roman Catholics and 49.3 per cent Protestants, making a total of 71.8 per cent. Since only 46.6 per cent of the population of the United States are members of a religious body, this would again accord with Bonger's finding that the criminality rate is higher among church-members than among non-church-members.

On the other hand, Dunn gives returns from five penitentiaries, according to which 362 out of 2,963, or only 1 : 8.2, had ever been active church-members. He also quotes the testimony of several judges, including that of Judge Lewis L. Fawcett, of Brooklyn, N. Y., that

> Approximately 2,700 cases have been brought before me in my five and a half years of service on the bench. During all this time I have never had to try a man who was at the time of the alleged offense, or ever had been, an active member of the church.
>
> I have asked each young defendant if he was a member of or an attendant at Sunday School, and I have never been answered "yes." I believe in Sunday Schools. When by means of suspended sentences or merciful devices I have seen fit to give prisoners opportunities to lead better lives in freedom, I have in every case insisted that the first thing they must do is to join a Sunday School.

Thus Dunn's evidence is conflicting.

Is there any other way of testing the influence of the churches on crime? One possible approach is by correlating the percentages of

church-members in different areas with the criminality rates of those areas. In 1926 the Bureau of the Census took its latest census of religious bodies, in which is tabulated the number of members of each denomination in each state. Similarly in 1923 a census of prisoners was taken, in the report of which is given for each state the ratio of the commitments from January 1 to June 30, 1923, for specified offenses per 100,000 population (Table 15-C). We have therefore official figures on which to base interstate correlations between percentage of church-members and commitment ratios.

For *total offenses* the correlations are: All religious bodies, -0.257 ± 0.092;* Roman Catholics, -0.066 ± 0.098; Methodists and Baptists, -0.147 ± 0.096. All these correlations are negative; in other words, states with high percentages of church-members show a tendency to low commitment ratios for total offenses. The correlations are, however, small; so small that they may well have arisen by sampling from a population of zero correlation.

For *homicide:* All religious bodies, -0.297 ± 0.090; Roman Catholics, -0.547 ± 0.069; Methodists and Baptists, $+0.588 \pm 0.064$. These correlations are in line with the correlations between church membership and the death rates from homicide given in the mortality statistics collected by the Bureau of the Census (Miner, 1929). This accordance of correlations derived from independent official sources is important confirmatory evidence of their validity.

For *Rape:* All religious bodies, -0.431 ± 0.080; Roman Catholics, $+0.004 \pm 0.098$; Methodists and Baptists, -0.384 ± 0.084. However, the Census Bureau, in its discussion of the commitment ratios, remarks:

> In making geographical comparisons for this offense it must be kept in mind that the term is not applied at all uniformly in different states. The differences noted may largely reflect variations in the 'age of consent,' and other differences between local statutes as well as real differences in the frequency of the crime. (p. 36.)

Let us find the net correlation between percentage of church members and commitment ratio for rape when age of consent is held constant. The latter, which is given in *Uniform Crime Reporting,* has a correla-

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* These probable errors are calculated from the formula, $PE_r = 0.6745\frac{1-r^2}{\sqrt{n-2}}$. In testing the probability that an observed correlation is a sample from a population of zero correlation, r should be set equal to 0 in the above formula. The resulting probable error is 0.098.

tion of $+0.297 \pm 0.090$ with the commitment ratio for rape, of -0.090 ± 0.098 with percentage of members of all religious bodies in the population, of $+0.088 \pm 0.098$ with percentage of Roman Catholics, and of -0.473 ± 0.076 with percentage of Methodists and Baptists. The net correlations between percentage of church members and commitment ratio for rape when age of consent is held constant are therefore -0.425 ± 0.081 for all religious bodies, -0.023 ± 0.099 for Roman Catholics, and -0.290 ± 0.091 for Methodists and Baptists. In other words, the correlations for all religious bodies and for Roman Catholics are little affected by correcting for age of consent, but a considerable part of the negative correlation between percentage of Methodists and Baptists and commitment ratio for rape turns out to be due to the low age of consent in states in which members of those churches are prevalent.

For *assault:* All religious bodies, $+0.075 \pm 0.098$; Roman Catholics, -0.007 ± 0.098; Methodists and Baptists, $+0.098 \pm 0.097$.

For *major crimes against the person* (homicide + rape + assault): All religious bodies, -0.025 ± 0.098; Roman Catholics, -0.106 ± 0.097; Methodists and Baptists, $+0.163 \pm 0.096$.

For *robbery:* All religious bodies, -0.273 ± 0.091; Roman Catholics, -0.044 ± 0.098; Methodists and Baptists, -0.284 ± 0.090.

For *burglary:* All religious bodies, -0.418 ± 0.081; Roman Catholics, -0.150 ± 0.096; Methodists and Baptists, -0.164 ± 0.096.

For *larceny:* All religious bodies, -0.316 ± 0.089; Roman Catholics, -0.187 ± 0.095; Methodists and Baptists, $+0.026 \pm 0.098$.

For the *principal offenses against property* (robbery + burglary + larceny): All religious bodies, -0.384 ± 0.084; Roman Catholics, -0.180 ± 0.095; Methodists and Baptists, -0.076 ± 0.098.

For *violating drug laws:* All religious bodies, -0.297 ± 0.090; Roman Catholics, $+0.034 \pm 0.098$; Methodists and Baptists, -0.279 ± 0.091.

For *violating liquor laws:* All religious bodies, -0.628 ± 0.060; Roman Catholics, -0.308 ± 0.089; Methodists and Baptists, -0.153 ± 0.096. When one considers the emphasis placed on prohibition by many of the churches, he is tempted to interpret these negative correlations as indicative of a true causal relation, to conclude that in states with large proportions of church members there are few violations of the liquor laws because of the salutary influence of the churches. However, in the Census Bureau's discussion of commitment ratios we read:

> There was likewise a roughly inverse relationship between the percentage convicted of violating liquor laws and the combined percentages convicted of drunkenness and disorderly conduct. The New England and Middle Atlantic divisions, which ranked first and second in the combined percentages convicted of drunkenness and disorderly conduct, ranked below all the other divisions in respect to the percentage convicted of violating liquor laws. The West North Central, East South Central, West South Central, and Mountain divisions, on the other hand, ranked below the other divisions in their percentages for drunkenness and disorderly conduct, while they ranked above all the others in the percentage sentenced for violating liquor laws. This condition does not imply that the number of cases of drunkenness was greater in proportion as violations of liquor laws were fewer. The figures suggest rather that there was an exceptionally large amount of drunkenness in those sections of the country where the enforcement of the liquor laws was relatively ineffective. (pp. 37-38.)

If a low commitment ratio is to be taken as an index of ineffective enforcement of the liquor laws, we have the unexpected result that the effectiveness of enforcement of these laws is in inverse rather than direct relation to the percentage of church members in the population. In other words, states with large percentages of church members are in general states where the liquor laws are poorly enforced.

For *drunkenness and disorderly conduct:* All religious bodies, -0.040 ± 0.098; Roman Catholics, $+0.057 \pm 0.098$; Methodists and Baptists, -0.155 ± 0.096.

For *fornication and prostitution:* All religious bodies, -0.113 ± 0.097; Roman Catholics, -0.128 ± 0.097; Methodists and Baptists, $+0.125 \pm 0.097$.

For *all other offenses:* All religious bodies, -0.277 ± 0.091; Roman Catholics, -0.080 ± 0.098; Methodists and Baptists, -0.081 ± 0.098.

In the following states the commitment ratios for certain offenses differ by more than five times the probable error from the mean: District of Columbia, total offenses, assault, major crimes against the person, larceny, drunkenness and disorderly conduct, fornication and prostitution; Maryland, assault, major crimes against the person; Colorado, robbery; Nevada, burglary, violating drug laws, violating liquor laws; California, violating drug laws. Perhaps these divergent ratios reflect local variations in the definition of offenses and in public policies of law enforcement which would make the recorded ratios incomparable. What effect would this have on the correlations previously recorded? Let us see. The correlations with these states omitted are as follows:

Total offenses: All religious bodies, -0.327 ± 0.089; Roman Catholics, -0.063 ± 0.099; Methodists and Baptists, -0.206 ± 0.095.

Assault: All religious bodies, $+0.050 \pm 0.100$; Roman Catholics, $+0.011 \pm 0.101$; Methodists and Baptists, $+0.136 \pm 0.099$.

Major crimes against the person: All religious bodies, -0.133 ± 0.099; Roman Catholics, -0.168 ± 0.098; Methodists and Baptists, $+0.242 \pm 0.095$.

Robbery: All religious bodies, -0.237 ± 0.094; Roman Catholics, -0.032 ± 0.099; Methodists and Baptists, -0.285 ± 0.091.

Burglary: All religious bodies, -0.351 ± 0.087; Roman Catholics, -0.150 ± 0.097; Methodists and Baptists, -0.105 ± 0.098.

Larceny: All religious bodies, -0.379 ± 0.085; Roman Catholics, -0.204 ± 0.095; Methodists and Baptists, $+0.007 \pm 0.099$.

Violating drug laws: All religious bodies, -0.162 ± 0.098; Roman Catholics, $+0.080 \pm 0.100$; Methodists and Baptists, -0.232 ± 0.095.

Violating liquor laws: All religious bodies, -0.675 ± 0.054; Roman Catholics, -0.400 ± 0.084; Methodists and Baptists, -0.074 ± 0.099.

Drunkenness and disorderly conduct: All religious bodies, -0.070 ± 0.099; Roman Catholics, $+0.093 \pm 0.099$; Methodists and Baptists, -0.233 ± 0.094.

Fornication and prostitution: All religious bodies, -0.151 ± 0.097; Roman Catholics, -0.138 ± 0.098; Methodists and Baptists, $+0.123 \pm 0.098$.

It is evident that omitting these doubtful states produces no great change in the correlations.

Considering the data as a whole what conclusion can we draw? Out of 42 correlations 33 or 79 per cent are negative, but of these only four differ by more than four times the probable error from zero correlation, while one of the positive correlations also differs from zero by this amount. We must also bear in mind that, if a low commitment ratio for violation of the liquor laws is to be taken as an index of ineffective enforcement, the three negative correlations in this category must be interpreted as unfavorable. There is probably some tendency towards a low negative correlation between percentage of church members and commitment ratios, a tendency which shows itself more clearly for the total religious bodies than for the Roman Catholics or the Methodists and Baptists separately, but there is not that invariable high negative

correlation which one might expect *a priori* for an institution which is traditionally one of the chief guardians of morality. There is little evidence in these data that the churches play any large part in the prevention of crime.

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JOHN R. MINER

QUOTATIONS

THE INHABITANTS OF THE ISLAND OF ST. KILDA AND ACUTE UPPER RESPIRATORY DISEASE[1]

In London, 1764, the Rev. Mr. Kenneth Macaulay,[2] minister of Ardnamurchan, published the entertaining and now very scarce work

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[1] Papers from the Department of Biostatistics, School of Hygiene and Public Health, The Johns Hopkins University, Baltimore, Maryland, No. 156.

The footnotes are by the present writer.

[2] Macaulay (1723-1779), whose life was uneventful, was the great-uncle of Lord Macaulay (1800-1859). He arrived at St. Kilda, one of the Western Isles of Scotland, as a missionary, in 1758. The island measures three miles from east to west and two miles from north to south. Except at the landing-place on the south-east, the cliffs rise sheer out of deep water, and on the north-east side the highest eminence in the island, Conagher, forms a precipice 1,220 feet high. It is said that in former times a St. Kildan was rarely known to die in his bed, being either drowned or having his neck broken by a fall over the cliffs. The inhabitants spoke Gaelic. The population was reduced to *30* souls by smallpox in 1724. Since 1851 the community has been decreasing in number as follows: 1851, *110*; 1881, *77*; 1928, *45*; and 1931, *0*.

For readable accounts of St. Kilda and its people of yesterday see the following: George Seton, "St. Kilda, Past and Present," 12 plates, small 4to, Edinburgh and London, 1878. xvi + 346 pp.

Richard and Cherry Kearton, "With Nature and a Camera, being the adventures and observations of a field naturalist and an animal photographer." 180 pictures, 8vo, London, 1897. xvi + 368 pp.

Norman Heathcote, "St. Kilda." 80 illustrations, 8vo, London, 1900. xiv + 229 pp. + map.

James Thomson (1700-1748), the Scotch poet, refers to the island in his poem "Spring" (lines 755-757) published in 1728:

> ". . . a craggy cliff,
> Hung o'er the deep, such as amazing frowns
> On utmost Kilda's shore, . . ."

See "The Poetical Works of James Thomson, a new edition with a memoir and critical appendices," by D. C. Tovey, 2v., 8vo, London, 1897; v. 1, p. 27.

For Dr. Macqueen's communication which refers to the St. Kilda boat colds see "An Account of the Epidemic Catarrh of the year 1782; compiled at the request of the Society [for Promoting Medical Knowledge]," by Edward Gray; *Medical*

entitled "The History of St. Kilda."[3] Samuel Johnson praised the work but was certain from a conversation he had with Macaulay when he and James Boswell visited the clergyman on 27 August, 1773,[4] that he had not written the book. Boswell at the same time records that he was told that the book had been written by Dr. John Macpherson of Skye from material supplied by Macaulay. We quote from Macaulay, pp. 200-209:

Another very remarkable disease that attacks this place occasionally, is a severe cold, sometimes attended with spitting of viscous bloody matter, every time the Harris people come among them, or strangers from any other quarter. "They are seldom troubled with a cough (says Mr. Martin[5]) except at the steward's landing which is no less rare than firmly believed by the inhabitants of the adjacent islands. Those of St. Kilda, upon the whole, gave me the following account: That they always contracted a cough upon the steward's landing; and it proves a great deal more troublesome to them in the night time, they then distilling a great deal of phlegm. This indisposition continues for some ten, twelve or fourteeen days; the

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Communications, London, 1784, v. 1, pp. 1-70. Dr. Macqueen is quoted on pp. 67-70. *Reprinted in* E. S. Thompson's "Influenza or Epidemic Catarrhal Fever, an Historical Survey of past Epidemics in Great Britain from 1510 to 1890; being a new and revised edition of 'Annals of Influenza' by Theophilus Thompson," 8vo, London, 1890, pp. 134-135.

A description of the 1913 influenza epidemic in St. Kilda by R. W. B. Hall will be found in *Guy's Hospital Gazette*, 1913, v. 27, pp. 347-349. Reprinted in *Journal of the Royal Naval Medical Service*, 1915, v. 1, pp. 294-299.

[3] THE / HISTORY / OF / St. KILDA. / CONTAINING / A Description of this remarkable Island; / The Manners and Customs of the Inhabitants; / The Religious and Pagan Antiquities there / found; / With many other curious and interesting / Particulars. / [single rule] / By the Rev. Mr. KENNETH MACAULAY, / Minister of *Ardnamurchan*. / Missionary to the Island, from the Society for Propa- / gating Christian Knowledge. / [double rule] / LONDON: / Printed for T. BECKET and P. A. DE HONDT, in / the Strand. MDCCLXIV.

7⅞" x 4⅞". *Frontispiece*, folding map. [8] + iv + 274 pp. + 2 pp. advertising.

Collation: [A] $^{8-4}$, B-S ^{8}, T $^{8-4}$.

[4] Boswell's Life of Johnson, including Boswell's Journal of a tour to the Hebrides, and Johnson's Diary of a journey into North Wales, edited by G. B. Hill; 6v., 8vo, N. Y., 1891; v.5, Tour to the Hebrides (1773) and Journey into North Wales (1774), p. 135.

[5] Martin, M. Voyage to St. Kilda, the most remote of the Western Isles of Scotland; giving an account of the very remarkable Inhabitants of that place, their beauty and singular chastity, their genius for poetry, music and dancing, their dexterity, diversions, habits, food, language, diseases, and methods of cure, their extensive charity, etc., etc. To which is added, An account of Roderick, the late Impostor there, pretending to be sent by St. John the Baptist. With cuts. 8vo, London, 1698; 4th ed., 1753.

A reprint of the fourth edition will be found in the more accessible work by John Pinkerton: A general collection of the best and most interesting voyages and travels in all parts of the world; many of which are now first translated into English; digested on a new plan. Illustrated with plates. 17v., 4to, London, 1808-1814; v.3, pp. 714-715.

most sovereign remedy against this disease, is their great and beloved catholicon, the gibain, (*id est*) the fat of their fowls, with which they stuff the stomach of the Solan-Goose,[6] in fashion of a pudding; this they put in the infusion of oat-meal, which in their language they call brochan; but it is not so effectual now as at the beginning, because of the frequent use of it. I told them plainly, that I thought all this notion of infection was but a mere fancy; and that at least it could not always hold; at which they seemed offended, saying, That never any before the minister and myself was heard to doubt the truth of it, which is plainly demonstrated upon the landing of every boat; adding further, that every design was for some end, but here there was no room for any, where nothing could be proposed. But, for confirmation of the whole, they appealed to the case of infants at the breast, who were likeways very subject to this cough, but could not be capable of affecting it; and therefore, in their opinion, they were infected by such as lodge in their houses. There were scarce young or old in the island whom I did not examine particularly upon this head, and all agreed in the confirmation of it. They add farther, that when any foreign goods are brought thither, then the cough is of longer duration than otherwise. They remark, that if the fever has been among those of the steward's retinue, though before their arrival there, some of the inhabitants are infected with it. If any of the inhabitants of St. Kilda chance to live, though but a short space, in the islands of Harris, Sky, or any of the adjacent islands, they become meagre, and contract such a cough, that the gibain must be had, or else they must return to their native soil. . . . . It is very remarkable, that after this infected cough was over, we strangers, and the inhabitants of St. Kilda, making up the number of about two hundred and fifty, though we had frequently assembled upon the occasion of divine service, yet neither young nor old among us all did so much as cough once more." This is the account which Mr. Martin gave of this infection in the year 1697. The same account has been often confirmed to me by many in my parish, whose veracity I had no occasion to call in question; and who visited the island almost annually since that period, and never knew the inhabitants to have once escaped this contagion. The honourable and reverend society,[7] and some ingenious gentlemen, who joined me in my suspicion as to the truth of this fact, recommended to me to enquire into it very particularly: And I can assure them and the public, that every man in St. Kilda, and every man in Harris that ever visited St. Kilda, are unanimous in affirming it to be true. Though my testimony may serve to corroborate a fact, which I once could not believe I cannot deny it without a trespass against truth. When I landed,

[6] "The Solan-Goose . . . equals a common goose in bigness; is by measure from tip of the bill to the extremity of the foot thirty-four inches long, and to the end of the tail thirty-nine; the wings extend very far, there being seventy-two inches distance betwixt the extreme tips; its bill is long, straight, of a dark colour, a little crooked at the point; behind the eyes the skin of the side of the head is bare of feathers, the ears small, the eyes hazel-coloured; it hath four toes, the feet and legs black, as far as they are bare; the plumage is like that of a goose. The colour of the old ones is white all over, excepting the extreme tips of the wings, which are black, and the top of the head, which is yellow, as some think the effect of age. The young ones are of a dark brown colour, turning white after they are a year old." Pinkerton, (Martin's Voyage to St. Kilda), *loc. cit.*, v.3, p. 709. See also, Pinkerton, (Martin's Description of the Western Islands of Scotland [2nd ed., 1716]), *ibid.*, p. 664.

[7] The Society for Propagating Christian Knowledge.

all the inhabitants, except two women in child-bed, enjoyed perfect health, and continued to do so for two days. I began to conclude, with pleasure, that my visit would do them no injury. But I concealed my suspicions, that I might not tempt them to impose upon me, in order to prevent me from detecting a trick, which was perhaps originally contrived for some political ends, (to justify, for instance, their aversion to strangers, who often come to oppress them) and continued for ages afterwards, from a pride which often makes mankind reluctant to confess, that they were either ignorantly or designedly mistaken. This far-fetched suspicion had no foundation. The St. Kildians are fond of strangers, and it is improbable that a trick of this kind, supposing we could assign a sufficient cause for contriving it, could be carried on by the whole community so very artfully, as to prevent a discovery for so many years. But my doubts and suspicions were soon removed. On the third day after I landed, some of the inhabitants discovered evident symptoms of a violent cold, such as hoarseness, coughing, discharging of phlegm, etc., and in eight days, they were all infected with this uncommon disease, attended in some with severe head-achs and feverish disorders: So that without rejecting the most convincing of all evidences, the evidence of my senses, I was not able to suspect that their complaints at that time, were either feigned or imaginary. Before I went to the island, I was willing to imagine, upon the supposition that this strange distemper gets in among that people on such occasions, that those only who assisted in dragging the boat to land, and must have wrought themselves into a great heat, so as to have rendered themselves very susceptible of such a disorder, were the only persons affected; but upon a strict examination, I found that the whole body of the people, they who stayed at home, as well as they who laboured hard in assisting the strangers, were seized with it.

Another conjecture I had fondly entertained, that the violent agitation into which the people of this island had thrown themselves, frequently by over-acting their part in drawing up the Harris boats to land, must have made them obnoxious to this severe cold, which might afterwards infect those who stayed at home, was sufficiently confuted by a very plain argument. Some of his Majesty's troops had occasion to land at Hirta,[8] in the year 1746, and though the natives gave them no manner of assistance, nor were of consequence over-heated, by a violent exertion of their strength, nor hurt by the salt water; at the same time it is certain, at least the natives and some of the steward's servants, who were then in St. Kilda, told me that the cold above described attacked them with uncommon fury; and the St. Kildians, as I shall have occasion to observe below, without any prejudice to their health, undergo greater hardships and fatigues almost every day, than on occasions of this kind. A gentleman of skill, who favoured me with his opinion, calls this cold *an annual epidemic*, which will return periodically, whether strangers visit the island or not. It is true, indeed, that the steward is obliged to visit this island sometime between the end of April and the beginning of September, as it is quite inaccessable in any other season of the year; but he sometimes lands here in May, sometimes in June, July and August; and is it not very strange, that an annual epidemic should return in May, if the steward lands in that month, but not till the month of August if the steward delays his visit so long? And is it not

[8] "The western land," the Gaelic equivalent of "St. Kilda."

equally strange, that it should return three or four times in the summer season, if the steward should land so oft, and only once, if they have no more visits from him? The present steward's brother, who is a clergyman of our church, and a man of learning and veracity, told me, that he saw the inhabitants of St. Kilda seized with this cold three different times, upon the landing of his father's boat as often, in the space of eight weeks.

I had a curious enough anecdote, concerning Mrs. M'Leod, a native of Sky, and widow of the late minister of St. Kilda, confirmed to me by herself and others: For three years after she went to the island she escaped the general infection; but afterwards being as it were, in some measure, become a native of the place, she was seized with it annually during her stay in the island.

Concerning the mystery of the St. Kilda boat colds, Boswell, in his life of Johnson, writes:[9]

A Lady of Norfolk, by a letter to my friend Dr. Burney, has favoured me with the following solution: "Now for the explication of this seeming mystery, which is so very obvious as, for that reason, to have escaped the penetration of Dr. Johnson and his friend, as well as that of the authour. Reading the book with my ingenious friend, the late Reverend Mr. Christian, of Docking—after ruminating a little, 'The cause, (says he,) is a natural one. The situation of St. Kilda renders a North-East Wind indispensably necessary before a stranger can land. The wind, not the stranger, occasions an epidemic cold.' If I am not mistaken, Mr. Macaulay is dead; if living, this solution might please him, as I hope it will Mr. Boswell, in return for the many agreeable hours his works have afforded us."

[9] Boswell. *Loc. cit.*, v. 2, pp. 58-59.

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RECENT LITERATURE

USEFUL IN THE STUDY OF HUMAN BIOLOGY

In this department will be noticed the books and reprints which are currently received at the Editorial Office. Publications intended for notice here should be addressed to Dr. Raymond Pearl, Department of Biology, School of Hygiene and Public Health, 1901 East Madison Street, Baltimore, Maryland, U. S. A.

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